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ABSTRACT

This book is a revised publication in the series on Aerospace Education II. It describes the employment of aerospace forces, their methods of operation, and some of the weapons and equipment used in combat and combat support activities. The first chapter describes some of the national objectives and policies served by the Air Force in peace and war. The second and third chapters examine the mission and structure of major Air Force operating commands. The fourth chapter describes the various support commands and operating agencies maintained by the Air Force to back up its combat forces. The last chapter reviews the aerospace role of the Army, Navy, and Marine Corps. (PS)

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# MILITARY AEROSPACE

U.S. AIR FORCE

Air Force Junior ROTC
Air University/Maxwell Air Force Base

2

SE 017 464

Aerospace Education II

# Military Aerospace

J. C. Smith
Academic Publications Division
3825th Academic Services Group

AIR FORCE JUNIOR ROTC
AIR UNIVERSITY
MAXWELL AIR FORCE BASE, ALABAMA

**1973**

This publication has been reviewed and approved by competent personnel of the preparing command in accordance with current directives on doctrine, policy, essentiality, propriety, and quality.

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This book will not be offered for sale. It is for use only in the Air Force ROTC program.

●

This text was developed under the direction of Maj Rodney V. Cox Jr, Aerospace Curriculum Course Director.

# Preface

THIS TEXT provides an overview of US Air Force combat and support organizations. It purpose is to present a dynamic view of the Air Force—not merely a description of organizations and their missions. It describes in some detail the employment of aerospace forces, their methods of operation, and some of the weapons and equipment used in combat and combat support activities.

The title of this text is not "United States Air Force" but "Military Aerospace." Major emphasis, of course, is given to the Air Force role in aerospace. However, contributions of the US Army and the US Navy are also included. We use this title primarily to help the student view the Air Force in its proper context; that is, as part of the total national defense effort.

The first chapter describes some of the national objectives and policies served by the Air Force in peace and war. The second and third chapters examine the mission and structure of major Air Force operating commands. Included is a description of the weapon systems used by these commands to perform their assigned missions. The fourth chapter describes the various support commands and operating agencies maintained by the Air Force to back up its combat forces. The concluding chapter reviews the aerospace role of the Army, Navy, and Marine Corps and briefly describes some of the weapons used by these Services.

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# *Chapter* 1

# Military Aerospace Forces

**THIS CHAPTER** includes a discussion of national objectives and policies and the function of the Armed Forces as instruments for pursuing these objectives and policies in peacetime and in varying degrees of conflict. It outlines the basic missions of strategic offensive, strategic defensive, and general purpose forces. After studying this chapter, you should be able to: (1) identify US objectives and policies in the field of foreign relations and describe the instruments used to achieve them, (2) discuss the basic principles governing the use of the military instrument, and (3) explain the organization and function of unified and specified commands in relation to their missions.

SINCE WORLD WAR II, the United States has maintained military forces without precedent among nations of the free world. Traditionally, the American people opposed large standing military forces and depended on rapidly mobilized citizen forces for defense. With the protection of two oceans and friendly nations to the north and south, the United States followed an official policy of isolation in its relationships with the rest of the world. But, with the advent of the nuclear age, supersonic aircraft, intercontinental ballistic missiles, and orbiting space systems, conventional methods of defense have become obsolete. American frontiers no longer lie within the continental United States. They now lie in the Pacific, in Africa, in the arctic wastelands, in the Middle East, and in other areas where the rights of people to determine their own destiny may be threatened. The United States can no longer rely on a citizen army for its security. It must maintain a strong professional military force to deter would-be aggressors from resorting to war to achieve their objectives.

Military power is only one of several instruments available to the President in carrying out national policy. Economic, political, and social institutions also play a vital role. However, without strength of arms, there can be no defense against a potential aggressor. In a reference to enemies of the United States, President John F. Kennedy once remarked: "We dare not tempt them with weakness. For only when our arms are sufficient beyond doubt can we be certain beyond doubt that they will never be employed."

## NATIONAL POLICIES AND OBJECTIVES

Just as the military instrument is only one of several instruments available to the President, aerospace power is but one element of the military instrument. The military instrument can be applied in a number of ways other than the outright use of force or the achievement of victory in war. The President and Congress can use it in various combinations with other instruments of power to gain national objectives and to support national policies.

What are national policies and objectives and how are they developed? The President usually expresses national policy when he selects a course of action to guide present and future decisions regarding national affairs. For example, he may state that he intends to build a great society, wage war on poverty, or oppose Communist aggression in various parts of the world. These are his objectives. He makes a statement of policy when he selects a course of action from several alternatives and explains why he chooses one course of action over another.

A national **policy,** in other words, is a broad course of action or a statement of guidance adopted by the Government in pursuit of national **objectives.** A nation's objectives determine its policy. For example, early American leaders stated broad objectives in the Preamble of the Constitution ". . . to form a more perfect union, establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity." In the field of foreign affairs, two fundamental national objectives have a direct relationship with our military instruments of national power:

1. Maintain the nation's territorial integrity and its access to international waters and aerospace
2. Preserve the nation's constitutional form of Government and its political liberties

Obviously, these are long-term national objectives. In addition to long-term objectives, other objectives apply more specifically to the security needs of the United States in the world that has emerged since 1945. These objectives are as follows:

1. Deter war and aggression;
2. Maintain a military posture that will insure victory in a general or limited war;
3. Strengthen the economic and military power of the free world; and
4. Increase the ability of free peoples to resist aggression and subversion.

Considered as a whole, these objectives are aimed at promoting the welfare and security of the United States. But they are also based on the fact that the United States can promote its own welfare and security by improving the welfare and security of other nations (Fig 1). Obviously, the military instrument alone cannot achieve such objectives. It must be used in combination with various political, economic, and psychological instruments of national power. In dealing with other countries, a nation may take one or several broad courses of action: (1) persuasion (political), (2) rewards (economic), (3) threat of punishment (psychological), and (4) force (military).

## USES OF THE MILITARY INSTRUMENT

In prehistoric days, Stone Age man had his instrument of power—a rock tied to the end of a stick. He did not refer to his weapon as a military instrument, but it was precisely that—a tool to satisfy his needs or to attain his objectives. From the rock tied to a stick, to the slingshot, to the bow and arrow, to

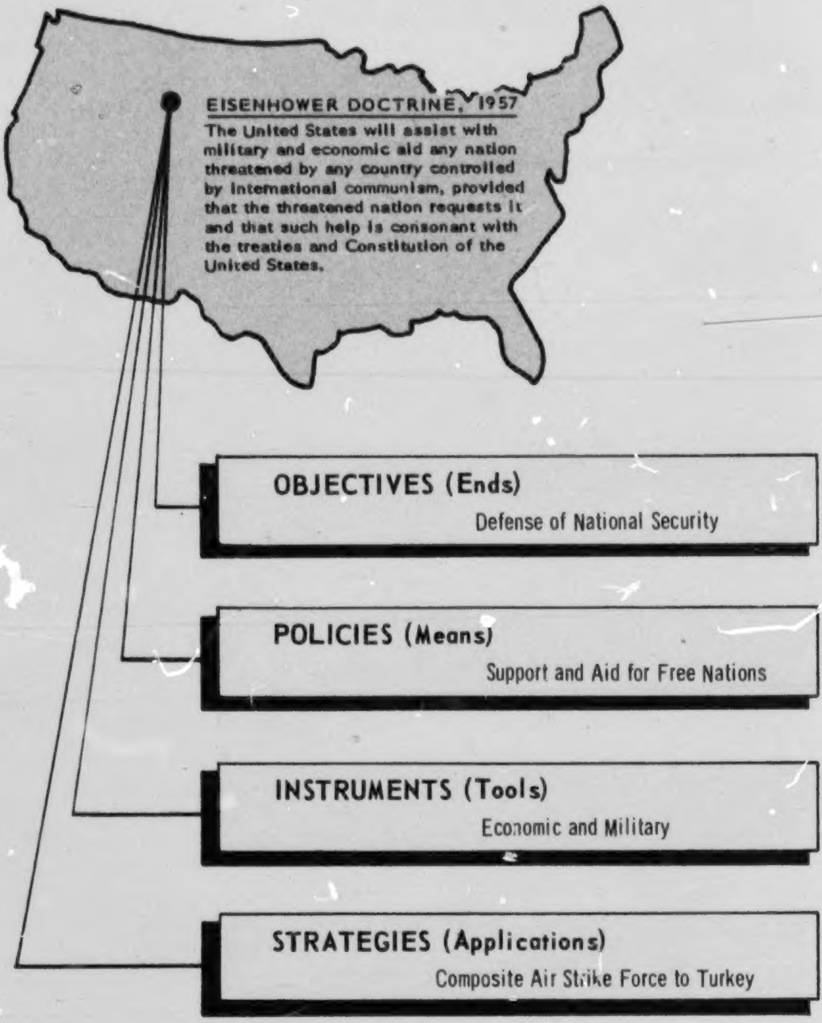
EISENHOWER DOCTRINE, 1957
The United States will assist with military and economic aid any nation threatened by any country controlled by international communism, provided that the threatened nation requests it and that such help is consonant with the treaties and Constitution of the United States.
OBJECTIVES (Ends)
Defense of National Security
POLICIES (Means)
Support and Aid for Free Nations
INSTRUMENTS (Tools)
Economic and Military
STRATEGIES (Applications)
Composite Air Strike Force to Turkey

Figure 1. International relations in action.

gunpowder, to nuclear weapons, man has always depended upon the military instrument as one means of achieving his objectives.

In this text, we are primarily concerned with the military aerospace instrument of national power. We examine the air elements of the Army, Navy, and Air Force and the manner by which these elements are combined to promote national welfare and security. The military instrument is employed much of the time in training, developing new weapons and tactics, and otherwise preparing for its major wartime role. Nevertheless, it continues in its role as an instrument of national power. It may be used to deter aggression, engage in small actions below the level of declared war, promote and gain the friendship of other nations, encourage support for national policies, and provide humanitarian services.

### Capability Demonstrations

Displays of combat might and potential to assist in establishing a nation's position and power are common practices in international affairs. In 1908, President Theodore Roosevelt sent the entire US battleship fleet, popularly known as the "Great White Fleet," on a world cruise to quell any doubts regarding the strength of the United States. In 1950, President Harry S. Truman sent the US Seventh Fleet to the Formosa Strait when differences flared between the Nationalist and Communist Chinese. This action not only had a deterrent effect upon the Chinese Communists but also indicated to the rest of the world that the United States was willing and, more importantly, able to stand behind its Allies.

Frequently, the United States uses its aerospace forces to demonstrate its capabilities without creating a provocative image. Not only are new weapons put on display, but newly developed techniques, equipment, and maneuvers are tested. New aerospace records in such areas as speed, distance, altitude, carrying capacity, and space exploration also favorably affect the nation's prestige and leadership in world affairs.

### Rapid Deployments

The rapidity with which aerospace forces can move from one area or task to another makes them especially effective national policy instruments. This was demonstrated in 1958 when the Tactical Air Command of the US Air Force and elements of other Services sent a special force to the Middle East to strengthen a faltering government in a time of crisis.

One of the most notable examples of mobility was the airlift that broke the Berlin Blockade of 1948 and 1949. In an attempt to halt the creation of a West German state, the Soviet Union imposed a tight blockade upon the western sector of Berlin. The United States responded with a massive airlift of food and other essentials for the 2,500,000 inhabitants in the beleaguered zone. For almost 15 months, cargo aircraft, C–47s at first and, later, four-engine C–54s, flew in an endless stream from bases in West Germany to the western sectors of Berlin. Only three narrow corridors were available for flights into Berlin. The Russians threatened to shoot down any aircraft that strayed from its designated corridor. In their attempts to force US aircraft from these corridors, the Soviets and East Germans used electronic countermeasures to jam radio and navigation aids. Soviet pilots frequently flew directly into the paths of transports to force them out of the corridors. In addition to constant harassment by the Russians, foul weather forced the airlift pilots to fly most of their missions on instruments. US aircraft carried 76 percent of the total airlift cargo that insured the survival of a free and independent West Berlin (Fig 2).

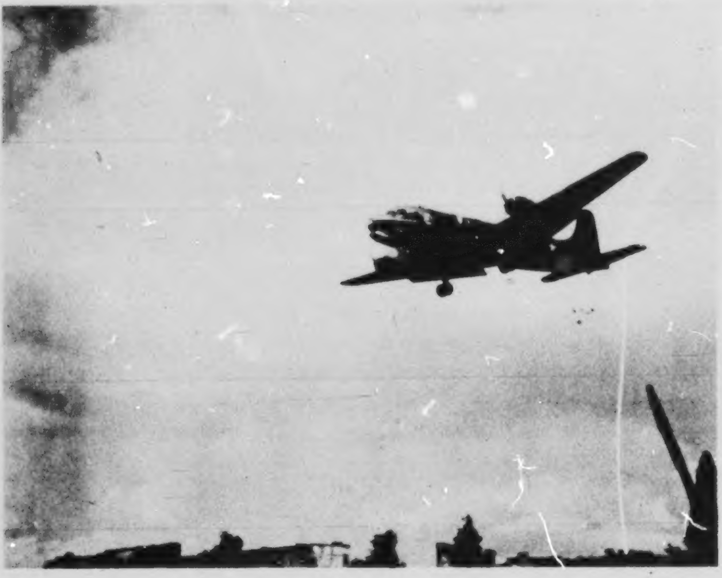

Figure 2. The pilot of this C–54 on Berlin Airlift dropped candy and gum on Berlin by means of small parachutes.

### Humanitarian Activities

Aerospace and other military forces can also promote national prestige and gain the friendship and admiration of other nations through humanitarian activities. "Special Warfare" forces of the Army, "Special Operations" forces of the Air Force, and personnel of all Services are trained in techniques of military civic action to render many kinds of constructive aid to populations. Such activities range from construction of village schoolhouses and sanitation facilities to direct help in harvesting crops. Medical aid deserves special mention. Whenever possible, US military medical personnel render aid to civil populations—dispensing medicines and shots against contagious diseases and treating the sick and injured. Military helicopters and other aircraft are employed to fight forest fires and render assistance in rescuing victims of floods, earthquakes, and other natural disasters.

The history of humanitarian airlift has been written year after year in numerous small missions of mercy. In natural disasters, plagues, and "cold war" episodes, the Military Airlift Command (MAC) of the Air Force and other US military air elements have come to the rescue of harassed humanity. From Chile to Japan, from Holland to Tanzania, MAC has transported iron lungs, insecticides, food, and medical supplies to distressed areas and has evacuated thousands of refugees from disaster areas.

## THE MILITARY AS AN INSTRUMENT OF FORCE

The primary mission of the military instrument is to deter war and to wage war successfully if deterrence fails. To accomplish this mission, the military must develop and maintain necessary forces to meet the requirements of modern warfare.

### Principles of Military Posture

Three basic principles govern the use of the military instrument as an instrument of force: deterrence of aggression, positive control, and flexibility.

DETERRENCE.—**Deterrence** is the prevention of an action by inducing fear of the consequences. A potential aggressor must know that the United States and its Allies have the strength to defeat an attack. A potential enemy must not only be aware of this strength. He must also have positive knowledge of US determination to use this strength.

Currently, the United States applies this principle in a strategy of **realistic deterrence** outlined in the Nixon Doctrine. In announcing this doctrine, President Richard Nixon stated the intention of the United States to build twin pillars of strength and partnership among nations of the world. In turn, the pillars of strength and partnership will provide the essential foundation for a third pillar—a willingness to negotiate. Based on this doctrine, the strategy of realistic deterrence evolved to provide for the security of the United States and its Allies. Realistic deterrence seeks to prevent war, but it also insures adequate capabilities to protect the United States and its interests if deterrence should fail.

Under this strategy, the United States seeks to create a new form of partnership with other nations. It will provide military assistance to other nations in their efforts to resist threats to their security and well-being. They, in turn, will assume more responsibility in providing manpower and other resources. The United States retains the responsibility for providing strategic forces to serve as a credible deterrent to nuclear war. Thus, through strength and partnership, the United States and its Allies will provide for their security and, through negotiation rather than confrontation, discourage the use of military force to settle differences.

POSITIVE CONTROL.—The United States must maintain effective and secure command and control over all its forces and weapons. This command and control system must also have the capability of surviving an enemy attack. For example, the Strategic Air Command maintains an airborne command post around the clock. On board a special aircraft, a general officer is prepared to assume command if other SAC command posts are destroyed by an enemy attack. Similarly, other airborne, seaborne, and underground command posts tied together by a protected communication system are maintained for use by the President and key civilian and military leaders. This complicated but vital system also reduces the likelihood that an unauthorized or accidental attack would develop into a full-scale war.

FLEXIBILITY.—The United States cannot hope to maintain a deterrence posture through massive nuclear power alone. In fact, without other options, it may produce the opposite effect. A potential enemy may be emboldened to make small or piecemeal attacks to gain his objectives at widely scattered points in the world. He could sponsor revolutions and civil disorders, encourage one small nation to attack another, or foment other disturbances. And he could accomplish these objectives, feeling quite confident that the United States would refuse the option of unleashing a major nuclear war. Therefore, the United States must maintain all kinds of military forces in a constant state of readiness, capable of responding to any situation or conflict with the appropriate degree of strength.

### Organization of the Military Instrument

Responsibility for developing and maintaining the military instrument is vested in the Department of Defense headed by the Secretary of Defense. Each of the Services maintains a separate department directly under the Secretary of Defense. Two separate command structures enable defense officials to relay high-level decisions rapidly to US forces throughout the world. One command structure controls the operational combat commands, and the other controls the supporting commands.

The line of operational command extends from the President to the Secretary of Defense through the Joint Chiefs of Staff to the commanders of the combat commands. The line of command for support of combat units extends from the President through the Secretary of Defense to the secretaries of the military departments and then to the individual military departments.

In this text, we are primarily concerned with the organization, mission, and function of the US Air Force within the Department of Defense and with the Air Force role in military aerospace. Although the Air Force receives major attention, it functions as one element of the nation's total military force structure. The other Services and civilian elements also make vital contributions to aerospace operations. Their roles are examined in the final chapter of this text.

DEPARTMENT OF THE AIR FORCE.—The head of the Department of the Air Force is the **Secretary of the Air Force,** a civilian appointed by the President with the advice and consent of the US Senate. The Secretary exercises his authority through civilian assistants and the Chief of Staff. Immediately under the Secretary is the Air Staff, Headquarters USAF, which consists of the Chief of Staff, US Air Force, the Vice Chief of Staff, five deputy chiefs of staff, and various other assistants.

LEVELS OF AIR FORCE ORGANIZATION.—Immediately below Headquarters USAF in the line of command, the Air Force is organized into 15 major commands and 8 separate operating agencies.

**Major commands** function either as operational or support commands. An **operational command** consists of strategic, tactical, or defense forces, or flying forces directly in support of such forces. **Support commands** conduct activities that provide supplies, weapon systems, support systems, operational support equipment, combat material, maintenance, surface transportation, administration, personnel, training, advanced education, and other special services.

Of the 15 major commands, eight are operational commands and seven are support commands. These commands are listed below:

### Operational Commands

Strategic Air Command (SAC)
Tactical Air Command (TAC)
Military Airlift Command (MAC)
Aerospace Defense Command (ADC)
Pacific Air Forces (PACAF)
US Air Forces in Europe (USAFE)
Alaskan Air Command (AAC)
US Air Forces Southern Command (USAFSO)

### Support Commands

Air Force Systems Command (AFSC)
Air Force Logistics Command (AFLC)
Air Force Communications Service (AFCS)
Air Training Command (ATC)
US Air Force Security Service (USAFSS)
Headquarters Command (HQ COM)
Air University (AU)

### Separate Operating Agencies

US Air Force Academy
Air Force Accounting and Finance Center
Air Force Data Automation Center
Headquarters Air Force Reserve
Air Reserve Personnel Center
Air Force Military Personnel Center
Air Force Office of Special Investigations
Air Force Inspection and Safety Center

The next level of organization in the Air Force command structure is the wing or group base. As is true of all Air Force organization, primary emphasis at this level is placed on the capability to accomplish wartime tasks without further reorganization. With certain exceptions, commands at this level are organized according to specific jobs required by their mission. Exceptions to this type of organization are some overseas commands, such as PACAF and USAFE, which are organized geographically.

A commander is responsible for all activities at the wing or group level of organization. Serving under the commander are two key personnel who report to the commander in their areas of responsibility—the deputy commander for operations and the deputy commander for logistics. A hospital commander and support group commander may be included on the commander's staff, depending on the mission and size of the base. The deputy commander for operations supervises activities required by the specific mission of the base and the assigned weapon system. The deputy commander for logistics is responsible for maintenance and supply functions. The hospital commander provides medical support, and the support group commander (normally also the base commander) is responsible for all housekeeping facilities on the base.

## TYPES OF MILITARY FORCES

The modern aerospace and nuclear age brought profound changes in the nature of warfare and in the types of military forces required to wage modern war. For example, differences in the traditional branches of the Service—the Army, Navy, and the Marine Corps—are not based solely on uniforms and customs. They stem directly from age-old differences between waging war on land and sea and the forces necessary for both types of warfare. In the first years of practical flight, the Army and the Navy used air power to support land and sea operations. But aerospace introduced a new medium of strategic warfare. This led to the designation of the Air Force as a separate Service in 1947 because, among other reasons, it could employ the nation's air power more effectively under its own command and strategic concepts.

Other changes have occurred since 1947. The advent of the missile era brought changes in military aerospace concepts, and these concepts, in turn, caused changes in methods of organizing

US military forces. The Air Force, Army, Navy, and Marine Corps are still the major US military forces, but these forces no longer operate as separate air, land, sea, and amphibious warfare forces. Instead, these Services now combine various operational task forces both in combat and in training. The Department of Defense now uses the following terminology to describe US military forces: strategic offensive forces, strategic defensive forces, and general purpose forces (Fig 3).

### Strategic Offensive Forces

A **strategic offensive** involves a full-scale attack on a major power. Its purpose is to destroy an enemy's ability to wage war—his industries, transportation and communication networks, population centers, and major military installations. His air and missile bases are particularly important because they provide him with a primary capability to mount a strategic attack against the US mainland. In today's world, it is highly unlikely that an offensive against a major power thousands of miles away would begin with a direct invasion of his homeland. In all likelihood, a strategic offense today would mean an attack through the aerospace medium with nuclear-armed missiles and/or manned bombers. To maintain its deterrent posture, the United States must possess this strategic offensive capability.

The heart of the US strategic offensive system is a combination of forces known as the **Triad.** The Triad is a three-pronged approach using Air Force land-based missiles and long-range bombers in combination with Navy missile-carrying submarines

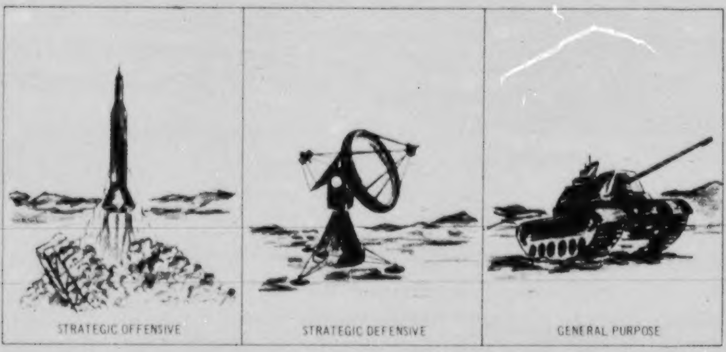

Figure 3. Three types of US military forces.

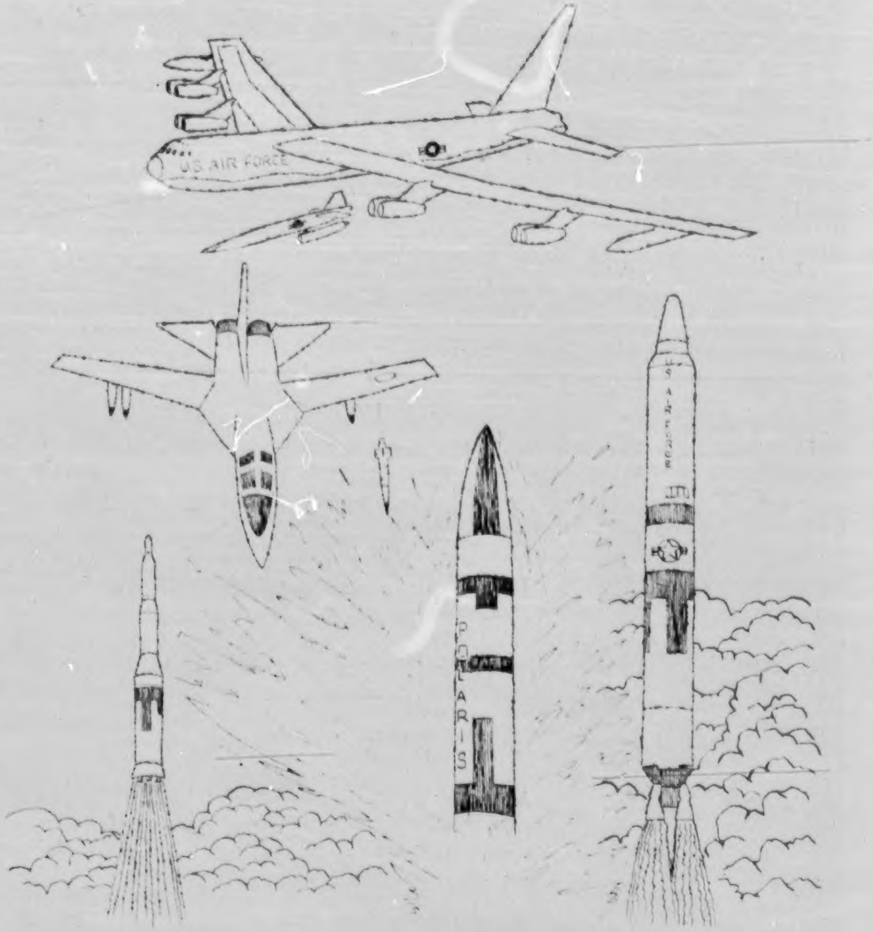

Figure 4. The Triad elements in action.

(Fig 4). This system strengthens the deterrent posture of the United States in two ways. It takes advantage of the unique capabilities of three different types of weapon systems and, at the same time, provides insurance against an unforeseen weakness in any one of the systems.

One component of the Triad includes land-based Titan and Minuteman missiles in hardened underground silos only minutes from their targets. Another component includes submarine-launched ballistic missiles (SLBMs), which have the same characteristics as the land-based missiles with the exception of hardened silos. However, the mobility of the SLBMs makes them an extremely difficult target for an enemy to locate and destroy. The third component of Triad is the manned bomber, which provides an entirely different type of offensive force. It can be launched rapidly and recalled without entering the airspace over an enemy's territory. It can be rerouted even after it is ordered to attack, and, when ordered to attack, it can strike a series of targets with a variety of weapons.

Dr Robert C. Seamans, Secretary of the Air Force in 1972, made this statement about Triad: "An enemy might be able to develop ways of neutralizing one or even two of these forces, but it is extremely unlikely that he could find methods of negating all three at the same time." An attack on any one of the Triad elements gives an alert and allows the remaining two to react.

Thus, a mixed force gives the United States more options in responding to an attack and creates greater problems for enemy defenses. Triad also helps to insure against a sudden breakthrough by the enemy in creating an effective defense against any one of our weapon systems.

### Strategic Defensive Forces

**Strategic defense** means defense against a strategic offense as described above. It means defense against aerospace attack. It does not include the aerospace defense of any US or Allied military forces or installations overseas; it is limited to the aerospace defenses of the North American continent—the protection of vital industrial, military, and population centers in the United States and Canada. It also does not include any concept of preemptive attack to destroy enemy aircraft or missiles on the ground. Instead, it is reserved for defending against such an attack after it is airborne, taking into account the enemy's potential for surprise and attempting to cope with it by electronic countermeasures and weapon technology. Strategic defense includes mammoth radar installations designed to give North America a scant 15-minute warning that enemy ballistic missiles are on the way. It includes a network of communications and control-and-warning nerve centers, coupled with surface-to-air missiles and interceptor aircraft, to deal with the manned bomber threat. Also included in strategic defense is the development of other defenses designed to deal with a variety of aerospace threats from both missiles and satellites.

Air Force elements devoted to the strategic defense mission operate under the Air Force Aerospace Defense Command (ADC). These forces comprise the greater part of the nation's strategic defensive resources, but the total of these resources includes elements from all US Services and elements of the Canadian Air Force. The Army's surface-to-air missiles are an important part of the defense against the manned bomber. The Navy contributes part of the anti-satellite warning system, and it can be called upon in an emergency to augment the interceptor force. All US strategic defense forces are united under the Continental Air Defense Command (CONAD), a unified command, but CONAD is part of the North American Air Defense Command (NORAD), an even larger command that includes the Canadian elements. Since it is bi-national, NORAD is called a combined command.

### General Purpose Forces

To maintain flexibility, the nation must have military forces capable of waging warfare at all levels and of meeting various national objectives short of war. In currently accepted terminology, a great war between two major powers, implying the possibility of strategic offense and defense, is called "general war." Smaller conflicts below that level are known as "limited wars." These are conflicts in which land and sea forces may be employed in their traditional roles of gaining and holding control of land areas and the seas and meeting and defeating enemy forces in combat. Obviously, the latter term covers a wide spectrum. Combat forces not specifically dedicated to strategic offensive or strategic defensive missions are also called **general purpose forces.**

General purpose forces include tactical air forces and main combat forces of the Army, the Navy, and the Marine Corps. They range from land, sea, and aerospace forces of tremendous firepower to forces especially tailored for "Special Operations" and trained in the techniques of psychological warfare, military civic action, guerrilla warfare, and counterinsurgency combat. Air Force general purpose forces also cover a wide range—from supersonic fighters, carrying tons of bombs and rockets to Special

Operations units flying supplies in light planes into a remote village threatened with guerrilla subversion or attack.

Air Force general purpose forces are organized and trained by the Tactical Air Command (TAC) and deployed to such overseas theater air commands as US Air Forces in Europe (USAFE) and the Pacific Command (PACAF). TAC and such theater air commands together comprise what are informally called "tactical air forces worldwide." In maneuvers, overseas deployments, and combat, tactical air forces are teamed with Army and other forces in unified commands. The US-based Readiness Command includes all the combat-ready units of TAC, together with all the combat-ready units of the Army not already deployed to overseas commands. Overseas or theater air force commands are similarly teamed with forces of other Services in the European Command, the Pacific Command, of which the US Military Command Vietnam is officially a part, and other geographically unified commands.

## WORDS, PHRASES, AND NAMES TO REMEMBER

deterrence
flexibility
general purpose forces
major commands
objectives
operational command
policy
positive control
realistic deterrence
Secretary of the Air Force
strategic defensive forces
strategic offensive forces
support commands
Triad

## REVIEW QUESTIONS

1. **What is the relationship of national objectives and policies to the welfare and security of the United States?**
2. **Discuss some of the uses of the Air Force as an instrument of national power, other than actual combat.**
3. **What three basic principles govern the use of the military instrument as an instrument of force?**
4. **Describe the Air Force organizational structure.**
5. **What is the role of strategic offensive, strategic defensive, and general purpose forces in the US defense system?**

## THINGS TO DO

1. Begin a collection of news stories, articles, and pictures that provide accounts of humanitarian missions performed by the Air Force.
2. Develop hypothetical battle situations to show how strategic offensive, strategic defensive, and general purpose forces would be used.

## *Chapter* 2

# Operational Major Commands

**THIS CHAPTER outlines the missions and operations of the Strategic Air Command (SAC), the Tactical Air Command (TAC), Pacific Air Forces (PACAF), and United States Air Forces in Europe (USAFE). The chapter explains the operational concepts that govern SAC's employment of manned bombers and intercontinental ballistic missiles. It then reviews the major types of tactical air operations and the relationships of the forces responsible for such operations. Also included is a description of the aircraft and weapons used by SAC and TAC in the performance of their missions. The chapter concludes with a brief discussion of two other major commands: Pacific Air Forces and United States Air Forces in Europe. After studying this chapter, you should be able to: (1) explain the missions and operations of the Strategic Air Command and the Tactical Air Command, (2) identify and discuss the aircraft and weapons used by these major commands, and (3) discuss the roles of Pacific Air Forces and United States Air Forces in Europe in tactical air operations.**

AS MENTIONED in Chapter 1, operational commands include the strategic, tactical, and defense forces that assist in carrying out national policies. Each of the eight operational commands is charged with a specialized mission, including strategic and tactical offense, strategic defense, strategic airlift, and air support for assigned geographical areas.

## THE STRATEGIC AIR COMMAND (SAC)

The major part of US strategic offensive power is vested in one Air Force command, the **Strategic Air Command.** SAC is the long-range nuclear strike force of the USAF and is directly responsible to the Joint Chiefs of Staff for execution of emergency war plans.

### The SAC Mission and Objective

The primary mission of SAC is to deter nuclear war by maintaining strategic forces in a state of readiness that insures the ability to win a global nuclear war under any circumstances. If deterrence should fail, these same forces must be capable of terminating any conflict on terms favorable to the United States. In the military sense, deterrence requires the possession of sufficient military power to prevent another nation from taking aggressive action through fear of the consequences. Therefore, deterrence includes the military strength to prevail in war, the national will and determination to develop and employ this capability, and acceptance of these facts by friend and foe.

To accomplish its mission of deterrence, SAC maintains a mixture of combat aircraft and missiles capable of immediate operations against an aggressor. A force of intercontinental ballistic missiles is capable of instant response to aggressive action in any part of the world. Missile combat crews are on continuous alert in launch control centers. They are prepared to launch these missiles immediately upon an order by the President. Within the warning time provided by the ballistic missile early warning system (BMEWS), approximately one-half of SAC's bomber and tanker force can be airborne and ready to respond to an enemy attack. Aircraft are loaded and prepared for the mission, and crews are assigned, briefed, and trained for targets to be attacked. SAC provides a number of options for use in countering conflicts below the level of general war. Its capabilities include strategic reconnaissance, air interdiction of enemy sea power, antisubmarine warfare and protection of shipping, and aerial mine-laying operations.

A vital element of deterrence is **sufficiency of forces** or a degree of military power that will successfully deter a potential enemy from attacking the United States or its Allies. Force sufficiency takes two forms—assured destruction and/or damage limitation. Assured destruction is a reference to the capability to destroy an aggressor nation. On the other hand, if US forces fail to deter an aggressor, measures must then be taken to limit the damage from an enemy attack on the United States.

To insure a sufficiency of deterrent forces, SAC functions as an element of the Triad described in Chapter 1. Triad provides the necessary mixture of manned and unmanned offensive and defensive weapon systems for the United States to maintain a realistic deterrent posture. No one can predict a potential enemy's intentions, the precise manner by which a war can begin, or the tasks that will be required in such an event. The Triad serves as an effective countermeasure against these uncertainties.

SAC is directly responsive to the President and the Joint Chiefs of Staff and is a specified command. In this status, it is an employing command—a command that takes action and employs resources. It is also a providing command—a command that builds resources. In this sense, its mission is to organize, train, equip, administer, and prepare strategic air forces for combat, including bombardment, missile, special mission, and strategic reconnaissance units. Here, the employing command and the providing command are one and the same. In other cases, as we shall see, they are different.

## SAC Organization

From its headquarters at Offutt Air Force Base, Nebraska, SAC conducts activities at bases throughout the world. The SAC Command Post, buried 45 feet underground, provides the commander with around-the-clock control of all SAC operations (Fig 5). This is the location from which he would direct his forces in the event of an attack. The command post contains elements and agencies

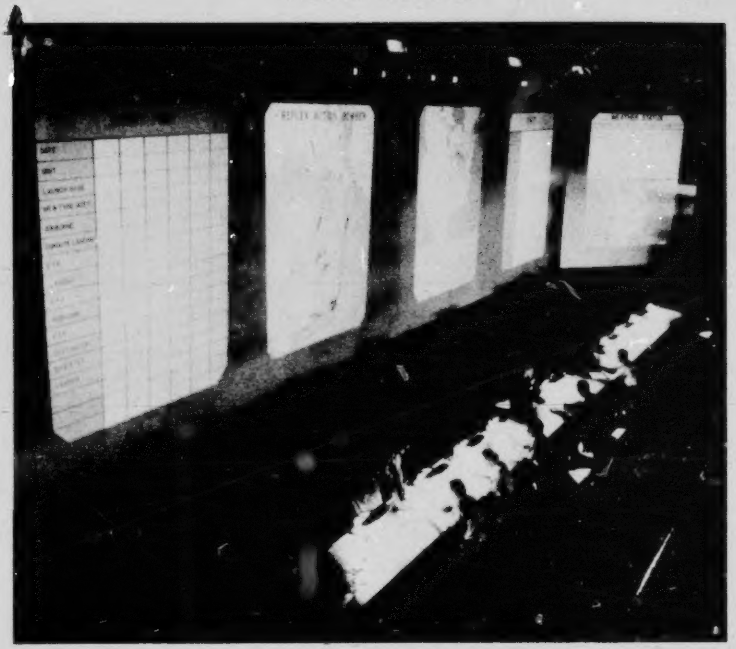

Figure 5. SAC Command Post.

vital to wartime operations: communications, tactics, intelligence, weather, and liaison advisers. The control system that can dispatch SAC bombers and missiles to predetermined targets is highly computerized and responsive. Centralized direction vested in the Commander in Chief, SAC, includes the authority to launch, divert, or recall the strike force. However, only the President of the United States has the authority to release SAC weapon systems against enemy targets. Although command and control is centralized at SAC headquarters, the responsibility to prepare this force for combat is decentralized to the lowest level of command capable of performing this mission.

The major subordinate commands of SAC are the Second, Eighth, and Fifteenth Air Forces and the First Strategic Aerospace Division. The Second Air Force is headquartered at Barksdale Air Force Base, Louisiana; the Fifteenth Air Force at March Air Force Base, California; the First Strategic Aerospace Division at Vandenberg Air Force Base, California; and the Eighth Air Force at Anderson Air Force Base, Guam (Fig 6).

Each major subordinate command headquarters has the following responsibilities: directing or supervising activities of assigned or attached personnel and maintaining them in a state of operational readiness; manning, equipping, and training assigned and attached units to accomplish the command mission; planning for and participating in disaster relief and other domestic emergencies; and performing other special missions as directed by the Commander in Chief, SAC.

The SAC wing is the basic unit for the employment of strategic air power. The principal types of wings are designated according to their squadrons. The bombardment wing may include both bomber and tanker squadrons. The air refueling wing consists of tanker squadrons, and the strategic missile wing consists of two or more missile squadrons. Whatever the type, the wing has the capability to sustain combat readiness while operating under a condition of continuous alert, with combat-ready crews and combat-ready systems. The wing commander is the combat force commander.

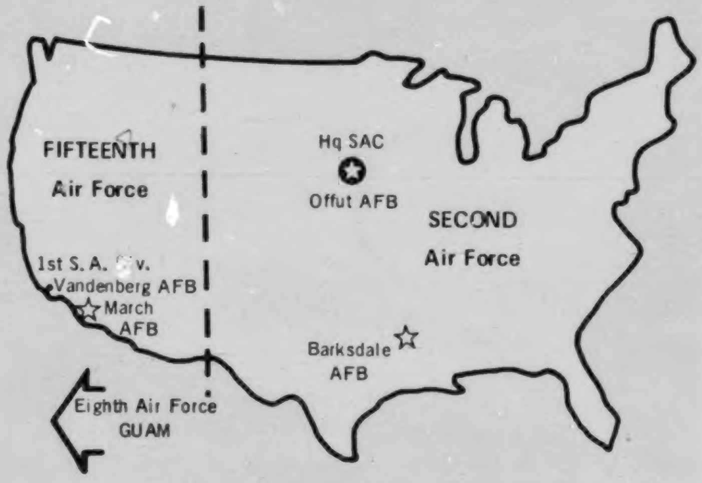

Figure 6. Strategic Air Command organization.

### SAC Preparedness

Two important aspects of keeping SAC ready for all contingencies are *survivability* and *training*.

SURVIVABILITY.—An aggressor of the future can be expected to attack with maximum surprise, speed, and destruction; therefore, plans for defending the United States must include preparation for enemy attacks that may come without prior warning. Among the top-priority SAC plans are those intended to insure the survival of a major part of the command's bomber and missile forces in the event of a surprise attack. Continuous advances in technology have brought the threat within minutes of the United States instead of days or weeks. In this environment, the United States must be prepared to retaliate with forces already in being according to battle plans developed and rehearsed before the attack occurs.

The Strategic Air Command has taken several measures to improve the survivability of its aerospace forces. These measures include establishing a fast reaction capability (alert), dispersal to satellite bases, hardening of missile sites, and exploiting the inherent mobility of aircraft.

*Alert.*—SAC depends heavily on the warning systems maintained by the North American Air Defense Command (NORAD). Around the clock, SAC forces on ground alert are geared to react within the warning time provided by NORAD's ballistic missile early warning system (BMEWS), described in Chapter 3.

*Dispersal.*—Aircraft and missiles are "soft" targets; that is, they are easily damaged or destroyed by blast, including even the relatively mild pressure from a bomb falling wide of its mark. Another problem is that SAC bombers require long, well-constructed runways and large, well-equipped installations, both of which are top-priority targets. SAC's Satellite Basing Program disperses the force to a number of bases and thus complicates a potential enemy's objective of destroying the force in one blow. Dispersal to a number of bases also makes additional runways available for launching the force. This permits more SAC aircraft to become airborne in less time. Similarly, dispersal of the missile force reduces the possibility of losing more than one launch site to an enemy missile or bomb. This, of course, requires a potential enemy to program additional forces to cover a wider area and reduces confidence in his plans.

*Hardening.*—As one part of the USAF contribution to the Triad, the SAC missile force must be protected on the ground against the possibility of a first attack by an enemy force. To provide such protection, the launch sites for these missiles must have assured survivability through hardening (reinforcement), concealment, or other measures. Early missiles were placed in virtually unprotected positions above the ground. Later models were stored horizontally in shelters, and they had to be raised for firing. They were eventually placed vertically in protected silos deep underground. Modern missiles are stored in their firing positions beneath the earth's surface.

TRAINING.—SAC forces must maintain the highest possible level of operational proficiency. This requires constant training and practice. All SAC units continually engage in training missions conducted under simulated combat conditions. Every member of these units is trained to assist in the SAC mission of penetrating enemy defenses, seeking out and destroying the target, and returning to his home base.

Crews and pilots are carefully matched, and they receive extensive proficiency training in the operation and management of SAC weapon systems. Constant training and frequent returns to the classroom are necessary for them to maintain their proficiency.

Missilemen, also carefully selected for their tasks, receive operational readiness training at Vandenberg Air Force Base, California. A missile combat crew is considered qualified and combat ready only after it demonstrates the ability to prepare a missile for launch within a specified time.

In addition to frequent and comprehensive evaluations by senior officers, SAC units receive at least one "no-notice" **operational readiness inspection (ORI)** each year by the Inspector General. ORI inspections are conducted at missile, bombardment, support, reconnaissance, and tanker units. These inspections are designed to test a unit's ability to accomplish its assigned mission under simulated wartime conditions. In addition to the annual ORI, each SAC tactical unit engages in a similar exercise conducted by the Commander in Chief, SAC.

### Employment in War

SAC prepares its forces for wartime employment in such functional areas as target planning, command and control, tactics, and conventional support.

TARGET PLANNING.—SAC must maintain prepared operational plans for various types of strategic actions. These plans are prepared by the command and by the Joint Strategic Target Planning

Staff (JSTPS) under the direction of the Joint Chiefs of Staff. Highly experienced Army, Navy, Air Force, and Marine Corps officers serve on the JSTPS under the direction of the commander of SAC.

Located at Offutt Air Force Base, Nebraska, the JSTPS consists of two operating divisions. One division analyzes strategic target information and maintains a "target list." The other division develops a single integrated operational plan (SIOP) for initial US retaliatory strikes in the event of global war. This division also assigns weapon systems to be committed by the unified and specified commands.

The SIOP furnishes detailed information for all operating elements included in the command plan—SAC bombers and missiles, Polaris/Poseidon submarines, fighter bombers overseas, the carrier at sea, and the Pershing missile. This single operating plan insures the coordinated employment of all nuclear delivery forces and provides for the most efficient use of these forces. However, the SIOP applies only to preplanned strikes. The situation after an initial nuclear exchange cannot be predicted with sufficient accuracy to plan for subsequent operations.

COMMAND AND CONTROL.—Command and control capabilities enable SAC to launch forces in response to an enemy attack as soon as a warning is received. Communication networks and electronic computers provide immediate and continuous information on the disposition and readiness of the SAC force. Alternate command posts are maintained at SAC's numbered Air Force headquarters. If an enemy attack destroys the headquarters and alternate command posts, then an airborne command post would take over to insure that SAC's global force would be launched and controlled.

The primary task of command and control is communications. The SAC communications network provides contact with aircraft in flight over all parts of the world. It insures that every unit of the force will begin its flight toward targets under positive control. This prevents the accidental launching of all or part of the US nuclear deterrent. Under this operational concept, the mere launching of SAC's strategic bomber force does not necessarily mean that they will proceed to their targets. When they reach a given point well outside enemy territory, bomber crews return to their bases unless they receive positive voice instructions to strike their targets. Only the President can authorize the SAC force to proceed beyond the positive control point. Positive control not only prevents accidental launching. It also guarantees that the force will be launched for survival while the decision is being made to strike an enemy target.

Missiles, of course, cannot be recalled after they have been launched. Therefore, every missile weapon system has interlocking mechanical and electronic devices that make it impossible for one individual to launch a missile. After an order to launch is received from the President, various individuals at separate points must simultaneously verify coded launch orders through multiple communication networks. Additional signals must be transmitted to or between missile launch crews before they can complete their countdowns and fire intercontinental ballistic missiles.

TACTICS.—The operational concepts that have been developed to insure survivability of the manned and unmanned SAC forces are basic requirements for realistic deterrence. However, the test of their effectiveness comes with their employment against an enemy's target systems. Tactics have been developed to insure penetration of an enemy's air defense system. These tactics are designed to insure minimum destruction of US forces and maximum strikes against enemy targets.

In penetrating an enemy's air defenses, aircraft can expect to encounter highly developed electronic defenses. This environment will include early warning radars, high powered radars that control interceptors and surface-to-air missiles, and defense communication networks. To insure successful penetration, the attack plan seeks to reduce the effectiveness of the enemy's electronic defenses through various deceptive measures, pre-arrival attacks on enemy defenses, and electronic countermeasures.

**Electronic countermeasures** include two broad categories of passive and active tactics used to roll back enemy defenses. Passive countermeasures are employed to avoid detection and to deceive the enemy. These measures include the use of evasive maneuvers, decoys, and chaff to monitor or control enemy radio and radar transmissions. Active electronic countermeasures involve the use of frequency jamming techniques to delay, confuse, and deny the enemy vital information that he needs to prevent penetration of his defense (Fig 7).

In the future, strategic missiles may employ active electronic countermeasures against an enemy's antiballistic missile system. In addition to increasing the survivability of the SAC missile force, such measures will complicate an enemy's efforts to deter the missile threat against his forces.

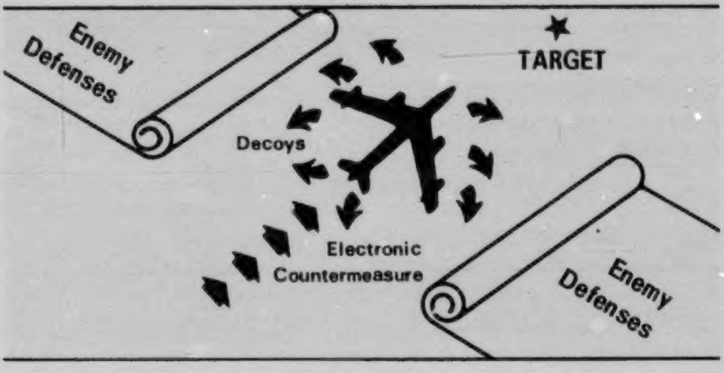

Figure 7. Roll back of enemy defenses through the use of countermeasures.

CONVENTIONAL SUPPORT.—In the past, SAC has been considered primarily as a force for employment in general war. But it also has an important role in smaller conflicts. By exercising its deterrent force, SAC can persuade an enemy to discontinue operations that threaten the security and well-being of the free world. With an increased retaliatory capability, SAC can provide a kind of strategic umbrella that permits other forces to resolve lesser conflicts with greater freedom of action.

In a conventional role, SAC has developed the capability to deploy conventional weapon forces rapidly in support of worldwide contingency operations. It has demonstrated a high degree of effectiveness in saturation bombing and ground tactical support. SAC KC-135 tankers have also played a leading support role in worldwide refueling operations.

### SAC Resources

A single weapon system cannot meet all of the requirements of the strategic mission. Therefore, SAC maintains a mixture of manned and unmanned systems in the proportions necessary to deal effectively with enemy threats. The SAC contribution to the mixed force concept includes controllable and reusable manned aircraft and rapid strike intercontinental ballistic missiles (ICBMs). These two systems represent the Air Force part of the Triad; the third part is represented by the Navy's ballistic missile submarines. Our concern here is the equipment used by SAC: manned aircraft, missiles launched from aircraft either as air-to-surface weapons or as decoys, and surface-launched ICBMs.

Manned aircraft.—When SAC was organized in April 1946, the B–29 was the mainstay of the SAC bomber fleet. For its time, the B–29 was a marvel of scientific and technical know-how. The B–47 was the product of advancing technology and the first jet bomber. It entered active service in 1951 as a deterrent weapon system. In 1966, the last B–47 was retired. SAC's entry into the supersonic bomber field came in 1960 with the B–58, which set many records in its 10 years of active duty.

The mainstay of the current SAC bomber force is the B–52. It was designed and built to deliver SAC's nuclear firepower. Besides SAC's nuclear delivery capability, the B–52 proved its flexibility in conventional or "iron bomb" missions in Southeast Asia. Its role was to disrupt supplies into South *Vietnam* by bombing the Ho Chi Minh Trail in Cambodia and Laos. In the latter stages of the war, the B–52 flew bombing missions over North Vietnam. Some people have credited the accuracy and effectiveness of these missions with bringing the North Vietnamese to the conference table and returning American POWs to the United States (Fig 8).

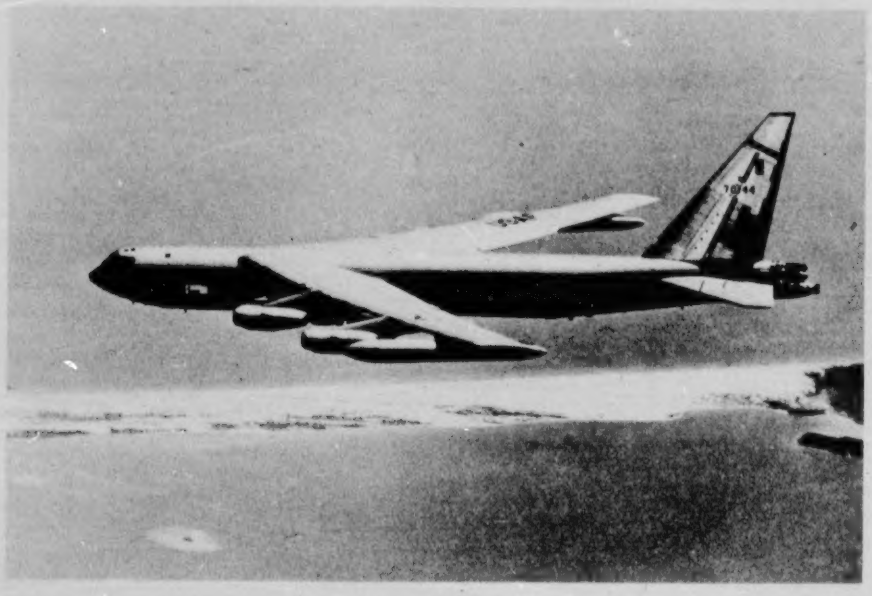

Figure 8. US Air Force B–52 enroute to a target in South Vietnam, 1968.

For years, the B-52s were viewed with disdain by the fighter pilots who were carrying the brunt of what was then known as "Pack VI" missions. These missions involved the bombing of strategic targets around heavily defended Hanoi and Haiphong. The fighter pilots called the B-52 a **BUFF** ("Big Ugly Fat Feller") or the "Aluminum Cloud." However, these derisive terms turned to affection when the BUFFs took on the toughest bombing missions of the war in December 1972.

The B-52s also supported ground forces in South Vietnam. Captured Vietcong soldiers stated that they feared B-52 attacks more than any other type of Allied action. After receiving their target assignments, SAC crews flew the B-52s to precise locations or initial points and began their bomb runs. Each B-52 could carry 60,000 pounds of bombs and deliver them on an exact target. Since the B-52s could drop their bombs from an altitude of approximately 30,000 feet, enemy ground forces were

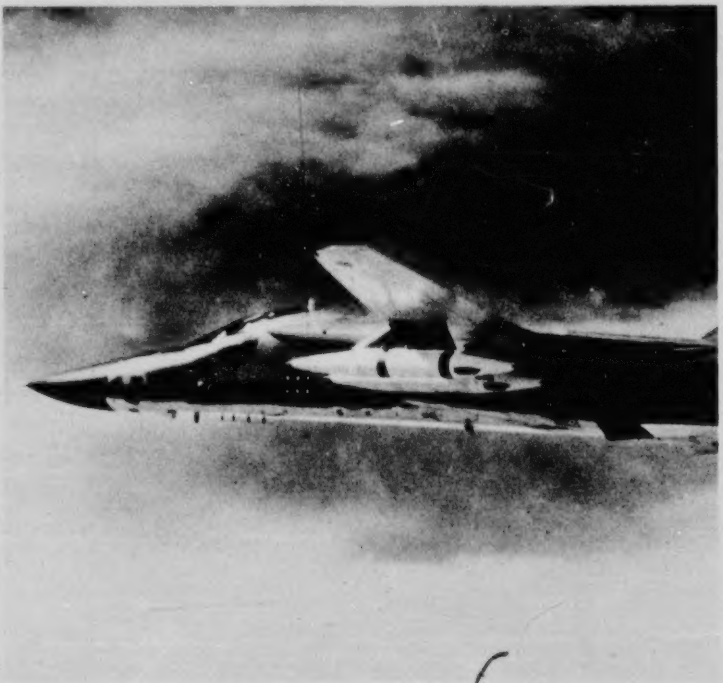

Figure 9. US Air Force FB-111

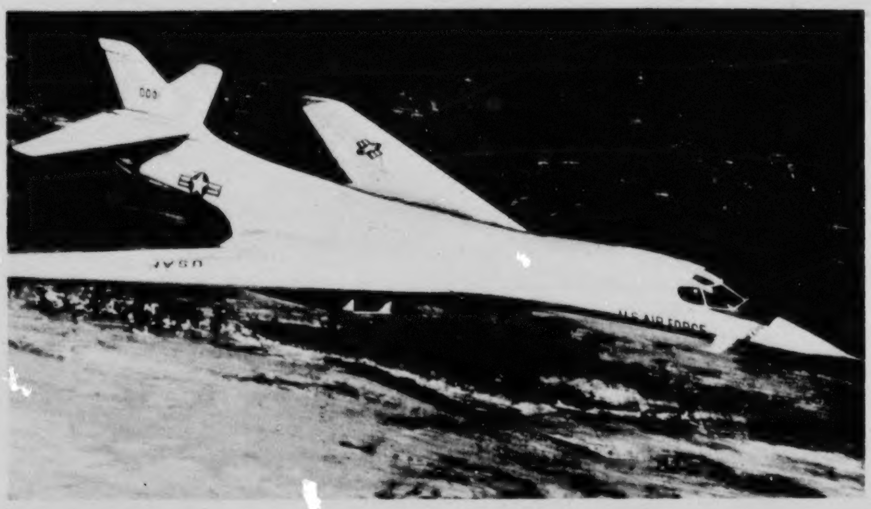

Figure 10. Artist's conception of US Air Force B-1 in flight.

aware that the bombers were near only when the bombs began to explode. There was no warning, and surprise was complete.

The B-52 has been in the SAC inventory since 1955. It has given almost 20 years of excellent service in the quest for peace. To augment the role of the aging B-52, SAC has formed four squadrons of FB-111s. The FB-111 will take off faster, fly faster and lower, and land on a shorter runway than the B-52. It flies **"on the deck"** (very close to the ground) without the pilot's control. Its terrain-following radar keeps the aircraft at a specified distance above the ground. Aircrews state that they must exercise a lot of will power to keep their hands off the controls and permit the plane to do the job. Since it can fly low, the FB-111 can avoid radar detection and can penetrate enemy defenses more easily than its predecessors (Fig 9).

For the future, the B-1 bomber is scheduled to replace the B-52. Although two-thirds as large as the B-52, the B-1 will carry a heavier payload, fly at speeds above mach 2, and penetrate enemy defenses more effectively. Its swing-wing design will enable it to fly efficiently at high and low altitudes, use shorter runways, and respond more rapidly than the B-52. It will be capable of carrying a short range attack missile **(SRAM)** and a subsonic cruise aircraft decoy **(SCAD),** both of which are being developed (Fig 10).

With a global mission, SAC extends the range of its bomber force through the use of KC–135 tankers for mid-air refueling. Today, aerial refueling is routine in SAC; however, only a few years ago, it was considered impossible. The man in the back of the tanker flies the boom into place as the receiving aircraft approaches. Once the boom is hooked into the receiver aircraft's receptacle, they are said to be "hooked up" and fuel is then transferred. Aerial refueling requires precision on the part of both the pilots and the boom operator. SAC's KC–135s refuel all Air Force tactical aircraft and some Navy and Marine Corps aircraft on a worldwide basis. Almost every mission flown over North Vietnam refueled from these tankers (Fig 11).

A typical mission involved a flight of four F–4s from Ubon Royal Thai Air Base in southeastern Thailand bound for a target over North Vietnam. After taking off and joining up, the four F–4s would fly to one of the tanker tracks over northern Thailand. SAC KC–135s would be flying up and down these tracks, refueling other aircraft until they emptied their tanks and were replaced by other KC–135s. This operation continued around the clock. During the refueling operation, the F–4s would proceed to the tanker track and search with their air-to-air radars for the tankers. Upon finding the tanker on radar, the F–4 navigator would vector the two aircraft together. As the aircraft came together, three of the F–4s would fly formation with the tanker while the fourth F–4 refueled. The pilot of the refueling F–4 would position his aircraft slightly below and behind the tanker.

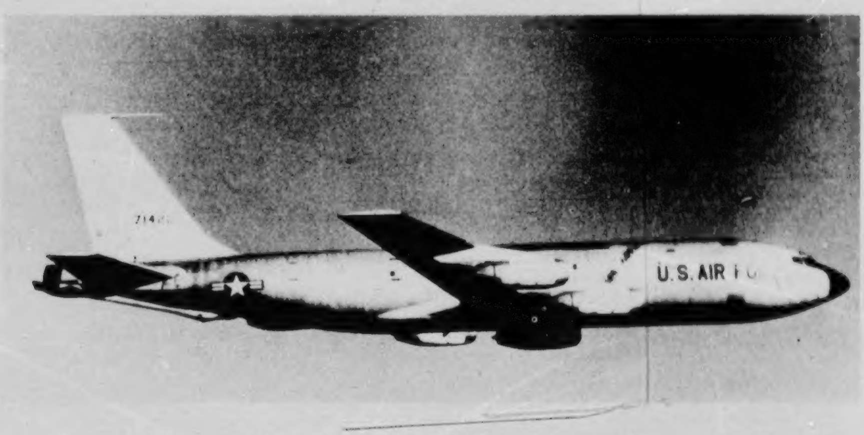

Figure 11. KC–135 tanker in flight over Vietnam, 1972.

Here he would fly tight formation with the KC–135. The tanker's boom operator flew the boom to the F–4's refueling receptacle, plugged in the boom, and filled up the F–4's tank. On command, the two aircraft disconnected, and another F–4 flew into refueling position. This process was repeated until all F–4s were refueled. The F–4s then proceeded to their target. After putting their ordnance on the target, the aircraft often refueled on the way home. This greatly extended the normal two-to-three-hour F–4 mission.

The KC–135 mission never became routine. After a hot dogfight, aircraft with damaged or low fuel tanks would call for emergency assistance, and the normal refueling routine would become a harrowing race for life. One F–105 flying from North Vietnam after a tough duel with a Mig ran out of fuel and his engine stopped just as the boom operator plugged in. An immediate descent by the KC–135 pilot enabled the F–105 to remain hooked up until it could take on enough fuel to restart its engine. This was typical of the quick thinking and action by tanker and fighter pilots that saved numerous aircraft and lives.

SAC's SR–71 collects photographic and reconnaissance information concerning an enemy's status (Fig 12). This aircraft can fly at more than three times the speed of sound at altitudes above 80,000 feet. It carries advanced equipment that can survey 60,000 square miles of the earth's surface during every hour of flight. Crewmembers wear space suits similar to those of astronauts.

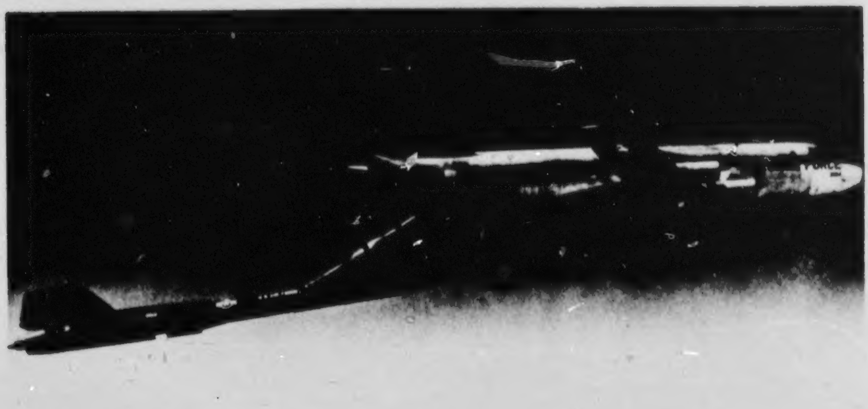

Figure 12. A SAC SR–71 (below) being refueled by a KC–135 (above).

AIR-LAUNCHED MISSILES.—Three types of missiles can be launched from SAC's manned bombers: the Quail, the Hound Dog, and **SRAM.** The Quail is a decoy that can be used to deceive or confuse an enemy's air defenses. The other two missiles are designed primarily as **defense suppression** weapons; that is, they are weapons for use at a distance against an enemy's air defense installations. These missiles can be used to clear the way for oncoming bombers or deal a knockout blow to the primary target.

The B–52 can carry the **Quail** missile as part of its electronic countermeasures against an enemy's defenses. This missile is only 13 feet long, but, when it is launched from a B–52, it produces an image or "blip" on an enemy radar screen similar to the image produced by the bomber itself. The missile flies at the same speed as the B–52, but it follows a different flight path to confuse the enemy defense system (Fig 13).

The **Hound Dog** is a supersonic air-to-ground missile capable of carrying a nuclear warhead over a range of more than 500 miles. A B–52 can carry two Hound Dogs, one slung beneath each wing (Fig 14). The Hound Dog is directed to its target by a self-contained inertial guidance system and is, therefore, not vul-

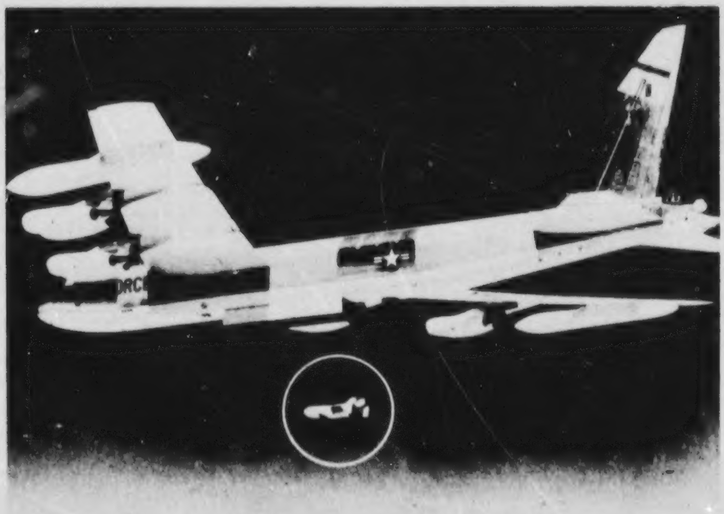

Figure 13. A Quail missile in flight after airdrop from a B–52 bomber.

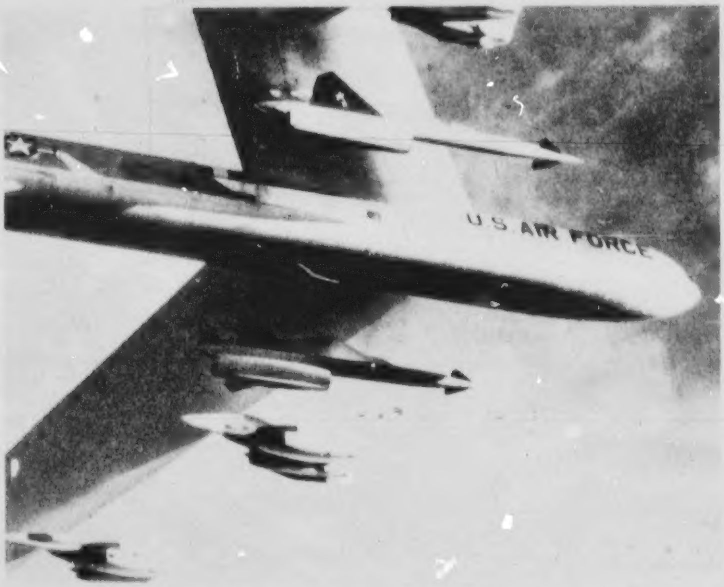

Figure 14. B–52 with Hound Dog missiles.

nerable to jamming by enemy countermeasures. Although the missile's guidance system is set before the B–52 takes off, any part of its mission can be changed before it is released from the aircraft. To confuse the enemy further, the missile can be launched from a high altitude and come in low over its target, or it can be launched from a low-flying aircraft and approach the target from a high altitude. And, while still attached to the B–52, the two Hound Dogs can be used as auxiliary jet engines to provide a boost in speed at a critical moment. This does not impair their range as missiles, however, because they can draw additional fuel from the B–52's main fuel supply.

SRAM is a "short range attack missile" with a nuclear punch comparable to a Minuteman intercontinental ballistic missile. Equipped with its own radar system, the SRAM is extremely accurate and can be programmed for an infinite number of flight paths. It is so effective that it virtually defies enemy interception and countermeasures. Both the B–52 and the FB–111 can carry this missile, (Fig 15) and, when the B–1 becomes operational, the SRAM will be a part of its weapon system.

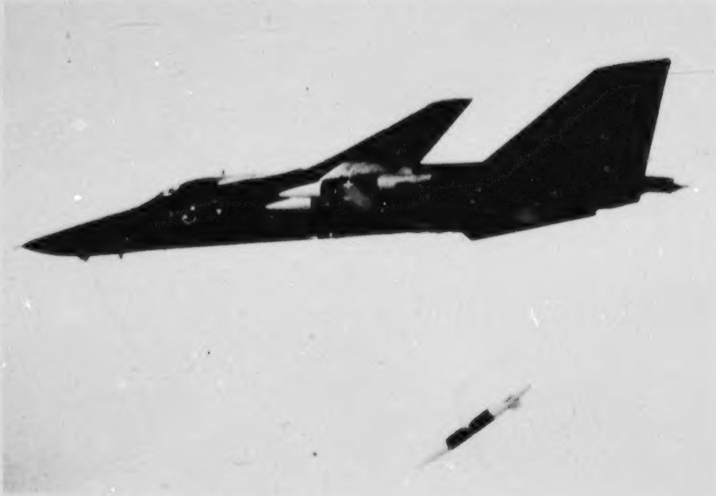

Figure 15. US Air Force FB-111A in flight in SRAM missiles.

INTERCONTINENTAL BALLISTIC MISSILES.—SAC's missiles and manned bombers complement each other. The ICBMs are quick-reacting and are adapted and dispersed for protection. SAC controls all of the nation's ICBMs, which include Titan II and Minuteman missiles.

Currently, SAC maintains 54 Titan II ICBMs on alert. The **Titan II** is an improvement over earlier Atlas and Titan I missiles and is the largest and most powerful ICBM employed by the United States. This model features several improvements, such as an inertial guidance system, more powerful engines, in-silo launch, greater reliability, increased payload, reduced launch time, and liquid-storable propellants (Fig 16).

The 1,000 **Minuteman** missiles on alert are the mainstays of the nation's ICBM systems. A new and improved Minuteman III missile entered the SAC inventory in 1970. This missile provides SAC with a new solid-fuel ICBM capable of launch in 30 seconds (Fig 17). In hardened and dispersed sites, the Minuteman is virtually immune to attack. Only a direct nuclear hit can stop it from firing.

Once the crews have gone through authentication and checklist procedures, two men at widely separated points must turn their keys simultaneously to initiate firing action. The action begins when the 90-ton silo cover is blasted aside, and the missile is cleared to fire. The quick-reacting Minuteman ignites and begins

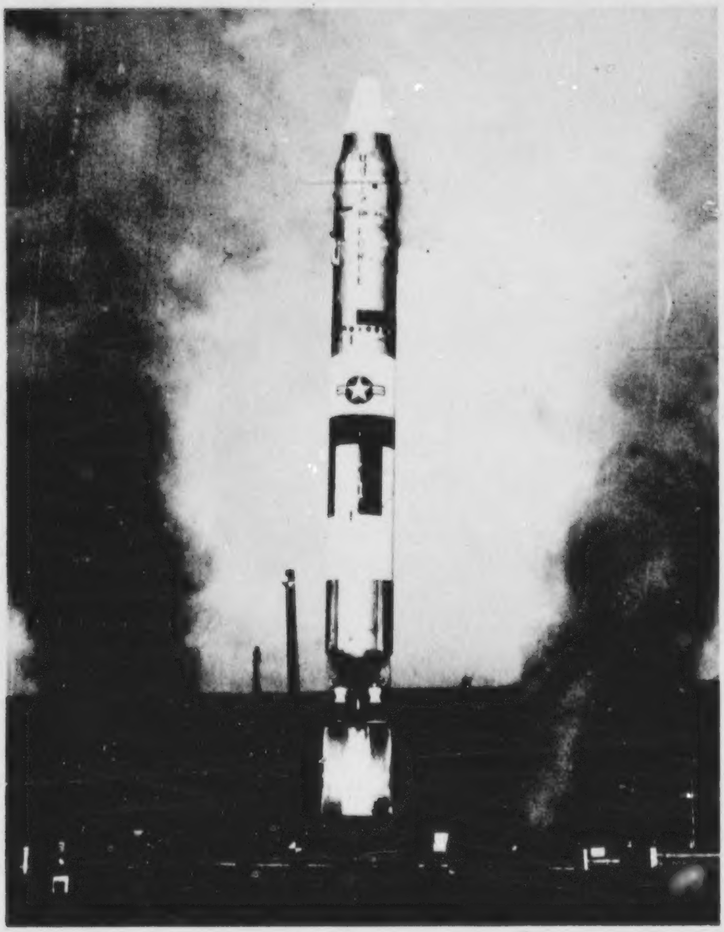

Figure 16. Launch of a Titan II ICBM from an underground silo at Vandenberg AFB, California.

its flight. With an improved third stage and reentry system, Minuteman III is capable of deploying multiple independently targeted reentry vehicles **(MIRVs)** together with such penetration aids as decoys and **chaff** (narrow metallic strips that produce false radar signals). MIRVs are inertially guided missiles released from a single vehicle or missile. When the missile reaches a prescribed point on its trajectory, the MIRVs are released and programmed to hit separate targets.

Figure 17. Launch of a Minuteman III at Cape Kennedy, Florida.

## THE TACTICAL AIR COMMAND (TAC)

As noted in Chapter 1, tactical elements of the US Air Force are known as "general purpose" forces. Air Force general purpose forces are trained for employment as single units or in coordination with ground and naval forces. Their purpose is to gain and maintain air superiority, seek out and destroy enemy forces and their supporting installations, and provide direct assistance to ground and naval forces in attaining their objectives.

The Tactical Air Command plays the major role in providing combat-ready general purpose forces for the Air Force. In this role, it is the air component of the newly created US Readiness Command, a unified command responsible for the combined combat forces of the US Continental Army Command and the US Air Force Tactical Air Command.

### The TAC Mission

The mission of the Tactical Air Command is to prepare combat-ready tactical air units for deployment to overseas commands and to supply tactical air forces for operations worldwide. TAC is also responsible for organizing and training personnel for assignment to unified commands requiring tactical air capabilities. Briefly stated, its mission is to provide fast-reacting tactical air forces anywhere in the world in coordination with other air, land, or sea forces. As already noted, in this role, TAC functions as a close partner of the Army in the unified US Readiness Command. During the Cuban crisis of 1962, it also joined forces with the Navy in the unified Atlantic Command.

Flexibility is one of the most significant characteristics of TAC's forces. In the event of a general war, TAC would be responsible for deploying a fixed number of tactical units overseas to augment the tactical forces of Pacific Air Forces (PACAF) and United States Air Forces in Europe (USAFE). In the early stages of the war, a portion of TAC's forces would be used to reinforce the Aerospace Defense Command in defending the United States against enemy air attacks. In the event of conflicts less than general war, TAC must be capable of deploying mobile strike forces to threatened areas anywhere in the world. It demonstrated this capability in the Berlin crisis of 1961 when it deployed regular tactical units and mobilized Air National Guard units to the European area.

In 1972, one of the largest and fastest deployments of any fighting force reinforced this TAC capability. TAC deployed the equivalent of 15 squadrons and 7,000 people to Southeast Asia over a very short period. The TAC commander at the time, Gen

William W. Momyer, called this type of responsiveness "the nub of our national strategy."

### TAC Organization

TAC forces are organized to insure effective operation both in peace and war. Presently, the command consists of TAC Headquarters, located at Langley Air Force Base, Virignia, three numbered air forces, a Special Operations Force, and certain schools and technical centers. The three numbered air forces are the Twelfth Air Force, with headquarters at Bergstrom Air Force Base, Texas; the Ninth Air Force, with headquarters at Shaw Air Force Base, South Carolina; and the Nineteenth Air Force, with headquarters at Seymour Johnson Air Force Base, North Carolina. The Special Operations Force (SOF) is a training and operations command with headquarters at Eglin Air Force Base, Florida.

TAC combat units and resources are divided between the Ninth and Twelfth Air Forces and the Special Operations Force. The Ninth and Twelfth Air Forces operate in geographic regions divided by the Mississippi and Ohio rivers. The Ninth Air Force includes all regular and assigned reserve units in the eastern part of the United States, and the Twelfth Air Force controls regular and assigned units in the western part. Between them, these two numbered air forces maintain tactical fighter, reconnaissance, airlift forces, and tactical control units trained and ready for immediate deployment wherever trouble spots may develop. Various bases used by these air forces support training schools and combat units of the US Air Force Readiness Command. Civil engineer training for overseas base construction is also a part of the TAC training program.

Among other tasks, the Nineteenth Air Force provides a highly mobile command element capable of assuming operational control of attached forces and deploying them to any part of the world. When TAC forces are assigned to unified commands, the Nineteenth Air Force advises the commanders on proper employment and assists in command and control as required. It has provided such command elements for the TAC composite air strike forces (CASF), a highly specialized and mobile force that can be deployed at a moment's notice.

In addition to its responsibility for providing combat-ready personnel and resources for US tactical air forces, TAC serves as the nerve center for the development of weapon systems, new tactics and techniques, and doctrine for the employment of tactical air power. The following TAC organizations operate independently of the numbered air forces and serve as doctrinal and technical centers:

The Air-Ground Operations School (AGOS) at Hurlburt Field, Florida, provides continuing instruction, primarily for officers of all Services, in air-ground operations to insure inter-Service cooperation. Air Force, Army, Navy, and Marine Corps personnel attend the school, which is conducted by an inter-Service faculty.

The Tactical Air Warfare Center (TAWC) at Eglin Air Force Base engages in operational testing and evaluation of equipment and techniques. It gathers data from special studies, engineering tests, and field exercises to improve operating tactics.

The Special Operations Force specializes in counterinsurgency, unconventional warfare, guerrilla warfare, military civic action, and psychological operations.

The Tactical Fighter Weapons Center (TFWC) at Nellis Air Force Base, Nevada, performs specialized fighter and related testing under the management of the TAWC.

Combat crews and tactical fighter units assigned to the Ninth and Twelfth Air Force provide advanced flying training in tactical air warfare. When pilots complete initial flying training provided by the Air Training Command, they are assigned to one of several TAC training units. Fighter pilots and aircrews receive A–7 training at Davis Monthan Air Force Base, Arizona; F–4 training at Luke Air Force Base, Arizona; and F–111 training at Nellis Air Force Base, Nevada. Tactical airlift crews assigned to fly the C–130 aircraft receive training at Little Rock Air Force Base, Arkansas, and Ellington Air Force Base, Texas. Aircrews assigned to fly the C–7A aircraft receive training at Dyess Air Force Base, Texas, and tactical reconnaissance pilots and aircrews receive training at Shaw Air Force Base, South Carolina.

### Tactical Air Operations

Tactical air forces perform five basic tasks: (1) counterair operations to gain air superiority, (2) interdiction, (3) close air support, (4) tactical air reconnaissance, and (5) tactical airlift. Performance of these tasks depends on the nature of the threat and on the results desired. Additional activities come under the heading of "special operations." Obviously, the range and nature of these activities make TAC the most diversified command in the Air Force. The first three are firepower tasks—the manner by which tactical fighter and attack aircraft use their guns, bombs, and rockets. Sometimes called the TAC "threefold mission," these tasks were recognized and set forth as basic air doctrine during World War II, and they are still important activities today. The other two are equally important tasks associated with the tactical air mission.

COUNTERAIR.—In the early stages of World War II, especially in the North African campaign, tactical air forces operated under the control of ground forces, and they were employed almost exclusively as a close air support weapon. US fighter aircraft did not gain air superiority, and their losses were high because they failed to attack enemy air bases. Furthermore, the close air support mission itself was ineffective because Allied air forces did not consider air superiority a priority mission. Following a conference with Allied military leaders in 1943, the US Army published a field manual, *The Command and Employment of Airpower*, which set forth the threefold mission of tactical air operations and emphasized the importance of air superiority. This same emphasis continues to be placed on counterair in US Air Force Publications.

The purpose of **counterair** operations is to gain air superiority by attacking and destroying enemy aircraft and missiles on the ground **before they can become airborne.** Targets include enemy airfields and immediate supporting facilities, aircraft, radar and other electronic guidance and control facilities, missile stockpiles, and missile launch sites.

Counterair operations also include air-to-air combat with enemy air forces after they have become airborne. Under the tactical concept, this includes air defense or interceptor operations. Under battle conditions, ground-control installations cannot be as large or elaborate as the NORAD direction centers. Instead, radar and communication facilities must be small, rugged, and portable, and they must perform a variety of tactical air control tasks in addition to ground-controlled interception. TAC supersonic fighters do not differ significantly as aircraft from the interceptor aircraft of the Aerospace Defense Command, but they are equipped with different weapons and fire-control systems for more versatile employment in both air-to-air combat and air-to-surface attack.

One of the most intense air-to-air counterair operations in history occurred over North Vietnam during the years 1965 through 1968. Part of the operation code named "Rolling Thunder" was led by such famous fighter pilots and leaders as Gen (then

Col) Robin Olds and Col (then Maj) Bill Kirk. Although this operation was conducted entirely over North Vietnam, the world's most heavily defended territory, the American pilots destroyed almost three North Vietnamese aircraft for every one American plane that was lost.

INTERDICTION.—The object of **interdiction** is to deny the enemy the use of communications and supply routes. Interdiction operations are designed to disrupt the flow of enemy supplies, men, and equipment through destruction, delay, or harassment. As stressed in the US Army field manual of 1943, command and control of air power must be centralized and exercised through the air commander. This principle is especially important in both air superiority and interdiction operations. The ground commander, of course, has a voice in the selection of interdiction targets, but tactical air reconnaissance is the best source of intelligence on the location and importance of these targets. Thus, the air commander is the logical person to control the timing and tactics of interdiction attacks. The principle of centralized control was proven repeatedly after it was applied in World War II. For example, in 1943, the advance of US and Allied ground forces in Italy was stalled with heavy losses. However, after an air interdiction campaign throughout the winter against roads, railroads, bridges, and communications behind enemy lines, the way was paved for the victorious advance up the Italian peninsula in 1944.

Interdiction was one of the Air Force's primary missions in the Southeast Asia conflict. The infamous Ho Chi Minh Trail, which fed supplies and men into South Vietnam, was the object of thousands of sorties by F–4, F–105, AC–130, and other types of aircraft. The trail was really a network of many well-concealed dirt roads. Very little effort was required to make these roads impassable. By the same token, little effort was required to repair them. The operation became a game with tremendous stakes. Since the enemy traveled almost exclusively at night, the gunships and truck destroyers became proficient at flying up and down the trails at night. For this reason, they were known as the "Roadrunners."

During the day, the fighter bombers knocked out parts of roads that were difficult to repair or bypass. At night, the "Roadrunners" flew to the points where roads were cut and attempted to destroy enemy trucks waiting for repairs on the roads. Obviously, each of these places was well-known and, thus, well defended by the enemy. Despite these defenses, only a small quantity of the supplies that left Hanoi and Haiphong actually reached South Vietnam. The enemy was also forced to use thousands of soldiers to maintain and protect the Ho Chi Minh Trail. Otherwise, these troops could have been used to fight in South Vietnam.

CLOSE AIR SUPPORT.—The objective of **close air support** is to assist ground forces in an immediate battle area by delivering aerial firepower against enemy surface positions. This type of operation demands close coordination and teamwork with ground forces because ground commanders select the targets. The success of close air support missions frequently depends upon the speed with which tactical fighters or attack aircraft respond to the requests of ground commanders. Army forces have firepower of their own, some supplied by Army aviation. Therefore, Air Force firepower used in close support must be limited to situations in which it can be the most effective. It supplements the firepower of ground forces, but it is not a substitute for their firepower. A general rule is that tactical close air support is best employed when ground troops are moving, either advancing or retreating.

TACTICAL AIR RECONNAISSANCE.—This is the oldest of military air missions, predating the airplane itself. Union forces in the Civil War used captive balloons to observe enemy positions. Aircraft first employed in World War I were used for observation before the tactical uses for aerial firepower were developed. Today, tactical aerial reconnaissance employs highly sophisticated electronic and photographic devices to report activity behind enemy lines.

Tactical air **reconnaissance** forces are the basic sources of information used in unified or joint military operations. These forces provide information about enemy air, naval, and ground forces; furnish close air reconnaissance support to surface forces; and monitor lines of communication and logistics support facilities. They analyze the terrain in combat areas, identify electronic targets, and report on weather conditions in a given area of operations.

TACTICAL AIRLIFT.—An outstanding example of tactical airlift occurred during the conflict in Southeast Asia. A small base at a place called **Khe Sanh** was located at one of the main feeder points of the Ho Chi Minh Trail into South Vietnam. This base overlooked a red clay (sometimes mud) road leading into Khe Sanh. The base was a key outpost to prevent enemy traffic from moving southward. US Marines and other military contingents were holding this base under some of the most intense fire and enemy attacks of the war. They had been surrounded by enemy forces, and their survival depended upon supplies from the air.

Tactical airlift aircraft, C–130s and C–123s, were assigned the task of resupplying Khe Sanh. The airfield at Khe Sanh was located in a valley bordered on one side by a high mountain. The approach to the airfield was difficult under the best of conditions, but the enemy had set up his guns on top of the mountain and zeroed in on the airfield and its approaches. In addition to the constant enemy fire, the weather was terrible. During most of the operation, heavy clouds almost completely covered the valley (Fig 18).

Despite foul weather, rugged terrain, and heavy gunfire, the tactical airlift men continued to fly into this valley and deliver the supplies. At times, aided only by radar, they had to thread their way through the mountains and drop the supplies into the weather on the command of the navigator. At other times, they flew into what appeared to be a quiet and beautiful valley only to be

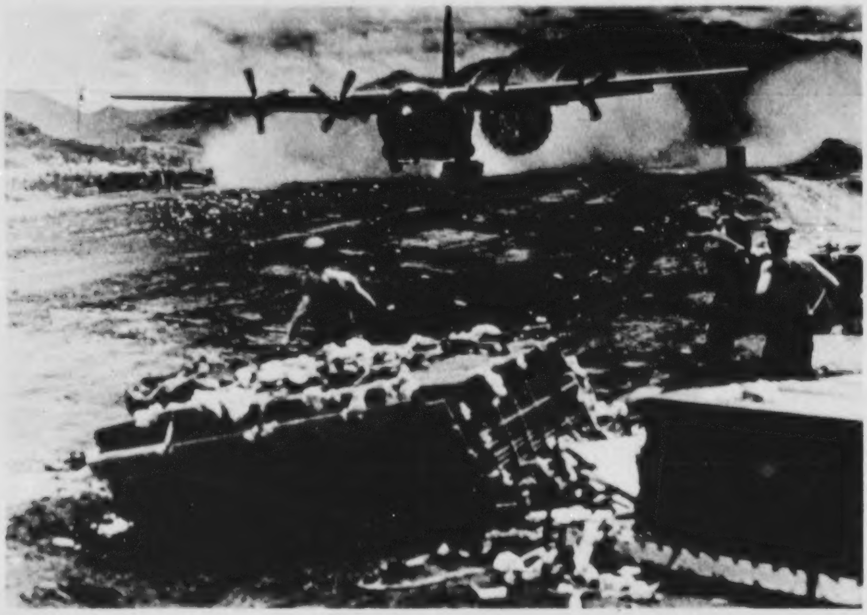

Figure 18. US Air Force C–130 making a low-altitude parachute extraction as it delivers cargo to Khe Sanh, Vietnam.

met by a deadly accurate barrage of gunfire after they touched down. The barrage kept up during the entire time that they were on the ground. Some aircraft were destroyed on the ground; others left with so many holes that they could have been labelled the world's largest soup strainers.

The enemy found it impossible to take Khe Sanh as long as the tactical airlift forces kept it supplied. And when the time came for the defenders to pull out, the airlift force flew into the valley to get them. The battle for Khe Sanh was the scene of one of the most heroic efforts ever undertaken by tactical airlift forces.

**Tactical airlift** is the movement of personnel and equipment to, within, and from, a given area and the forces that carry out such operations. Tactical airlift forces are organized, equipped, and trained to move combat forces and materiel under situations that may range from small movements in battle areas to major movements over long distances. Airlift functions include four basic tasks: logistical airlift operations, airborne operations, tactical aeromedical evacuation, and special air support operations.

Logistical airlift opeartions consist of the routine movement by air of combat units, materiel, and personnel within an area held by friendly forces. Delivery is made by the most suitable resources available—airdrop to a required point, free drop of certain types of cargo from low altitudes, and extraction with ground equipment hooks that pull cargo from the rear of low-flying aircraft.

Airborne operations include the delivery and resupply of airborne units into territory held by hostile forces or the delivery of combat units directly into combat positions. In combat areas, successful airborne operations divert enemy troops from the main battle area and force the enemy to guard his rear areas against airborne attack. Basically, all airborne operations are essentially the same, varying mainly in size, time, and objective.

Tactical aeromedical evacuation consists of operations concerned with the movement by air of sick and wounded personnel. Like logistical airlift operations, aeromedical evacuation is the responsibility of the Air Force component commander. This service provides for the movement of casualties to treatment facilities to the rear of battle areas. Because of TAC's capability to react with flexible and versatile forces, a wounded member of the armed forces today has far better chances of survival than his counterpart in World War II and the Korean War.

Special air support operations consist of tasks not included in the other three categories. Many of these tasks are highly classified and must be performed with extreme care. Tactical airlift aircraft can support a variety of missions related to counterinsurgency, unconventional warfare, and psychological operations. In addition to their capability for moving troops and cargoes, they can be rapidly equipped for medical evacuation, forward air control, and night flare operations.

TACTICAL AIR CONTROL SYSTEM.—The subject of tactical air control is far too involved for detailed treatment in this text. Here, we set forth only a few of the principles applicable to the operation of the tactical air control system **(TACS).**

TACS governs the performance of the basic tasks described above to insure the coordination of tactical air power with the forces of the other Services. It operates in conjunction with the Army Air-Ground System (AAGS) and provides for a rapid exchange of battle information, coordination of Army and Air Force air defenses, and coordination of air and ground operations. The system has the flexibility necessary for either large- or small-scale operations, depending upon battle conditions. It is organized and equipped to control all tactical air operations, whether they are conducted as independent functions or in coordination with land and naval forces.

By using TACS, a commander can shift, redeploy, and concentrate his forces to meet rapidly changing situations. Through this single centralized system, he can control counterair, interdiction, close air support, tactical air reconnaissance, tactical airlift, special operations, and other air activities. The system provides for liaison at all levels with the forces of other Services operating in or through a combat zone. It enables the commander to plan and coordinate his operations with those of other commands to achieve an objective. Communications and electronics support is a vital part of the TACS.

### Tactical Aircraft and Weapons

The Tactical Air Command is the most diversified command in the Air Force because it must be capable of fighting in either a general or limited war environment. Therefore, it uses the widest variety of aircraft and weapons of any other major operational command. In conventional tactical air warfare, it requires high-performance aircraft and the ability to deliver nuclear or conventional weapons. Special operations require specially adapted aircraft and weapons. Various aircraft and weapons employed by TAC and overseas tactical air commands are briefly described below.

FIGHTER AND ATTACK AIRCRAFT.—In counterair, interdiction, and close air support roles, tactical air forces employ jet fighters ("F" prefix) and attack aircraft ("A" prefix). Heavily armed supersonic fighter aircraft are considered capable of both air-to-surface strikes and air-to-air combat. Attack aircraft are designed mainly for use against ground targets. However, a new attack aircraft, the A-7D, is designed not only for close air support but also for short-range interdiction missions. Attack aircraft range from heavy jets capable of large weapon payloads to reciprocating-engine aircraft especially adapted for special operations.

*Fighter aircraft.*—Supersonic fighters used by tactical air forces include the F-100 Supersabre, F-105 Thunderchief, F-4 Phantom II, and F-111.

The F-100 Supersabre was originally designed as a day fighter, but technical improvements on later models made it a versatile tactical fighter. It was the first Air Force operational fighter capable of supersonic speeds in level flight. This aircraft demonstrated its versatility and effectiveness as a forward air controller in Southeast Asia. F-100Fs were used over North Vietnam to find hidden targets and direct fighter bombers for the attack. These were two-seat models that operated unter the call sign, "Misty." The Misty FACs proved that fast aircraft could operate as forward air controllers in an extremely hostile environment. Although the F-100 is no longer employed as a first-line fighter aircraft, it is still used by the Air National Guard.

The F-105 Thunderchief is designed to perform counterair, interdiction, and close air support missions (Fig 19). This is the first fighter aircraft to incorporate an internal bomb bay, which is usually used to carry an auxiliary fuel tank. For years, the F-105 was the primary strike aircraft used against enemy interdiction targets in Southeast Asia. Today, it is used primarily to suppress surface-to-air missiles (SAMs) with such weapons as the AGM-45 SHRIKE and AGM-78 Standard ARM. These SAM suppressors operate under the nickname, **Wild Weasels.** They ferret out a SAM site by allowing the SAM to lock its radar beam on their aircraft. The two-man F-105 crew must then launch its missiles before the SAMs are fired. This deadly game was played hundreds of times in Southeast Asia because Weasels accompanied every strike force.

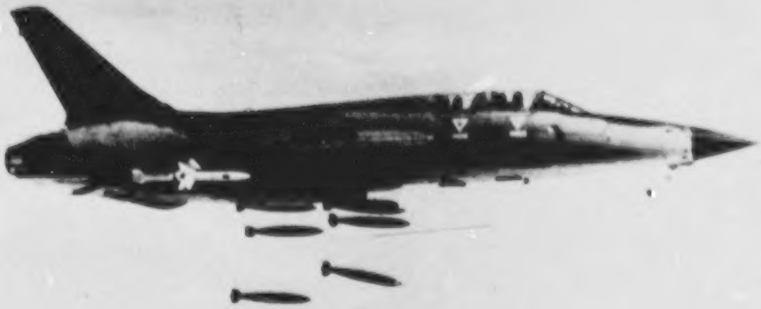

Figure 19. F–105F Thunderchief armed with AGM–45 Shrike missiles. It is dropping conventional bombs on a target in North Vietnam.

The F–4 Phantom II, the Air Force version of an original Navy design, can perform all of the tactical air functions. It is currently the most advanced multipurpose fighter in the TAC inventory. This aircraft is designed for operation by two crewmembers and is capable of delivering both nuclear and nonnuclear weapons (Fig 20). It has proven itself as a superior fighter over North Vietnam and in the Middle East. As the air war over North Vietnam drew to a close in 1973, the F–4 had produced the first three aces of the Southeast Asian conflict. Capt Richard S. Ritchie, a pilot, downed his fifth enemy aircraft, a Mig–21, on 28 August 1972 to become the first ace. He was followed by two rarities in modern warfare, navigator aces. Capt Charles D. DeBellevue, who eventually downed six enemy aircraft, and Capt Jeff Feinstein, both F–4 navigators, achieved ace status in the fall of 1972. The F–4 was credited with more enemy aircraft downed than any other US aircraft.

The F–111 is the most complex tactical fighter in the TAC inventory. This aircraft serves primarily as an all-weather, around-the-clock fighter against targets deep inside enemy territory. With its variable wings fully extended, it can take off in less than 3,000 feet or loiter over a battlefield for precision strikes. With its wings fully retracted, it becomes a delta-wing fighter that can

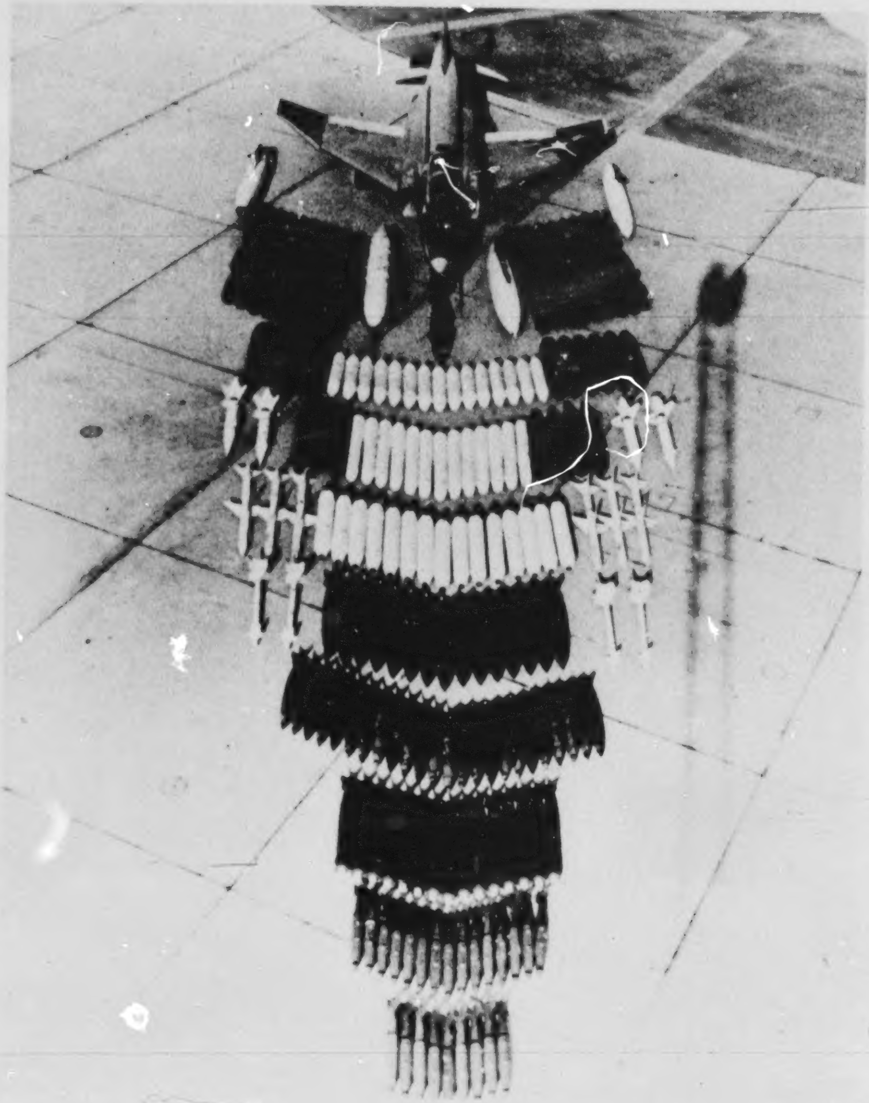

Figure 20. An F–4 Phantom shown with some of the weapons that it can carry.

easily exceed the speed of sound at low altitudes or fly at two and one-half times the speed of sound at high altitudes. It carries a two-man crew and a heavy load of conventional or nuclear weapons. It has the range of a transport, the carrying capacity and endurance of a bomber, and the maneuverability of a fighter.

*Attack aircraft.*—One of the newest additions to the TAC inventory is the A–7D Corsair II, a single-engine, subsonic attack aircraft designed to meet close air support requirements. This aircraft can carry a 15,000-pound payload and can deliver more than three times the bombload in a given radius than the F–100. It has an expanded fuel capacity that permits longer unrefueled flight and airborne loitering, and it also has a highly sophisticated navigation and weapon control system for more accurate weapon delivery. A heads-up display **(HUD)** device simplifies the pilot's operation of the aircraft. This device presents eye-level information for attack, navigation, and instrument landing and allows the pilot to look outside the aircraft while he obtains flight information with instrument accuracy (Fig 21).

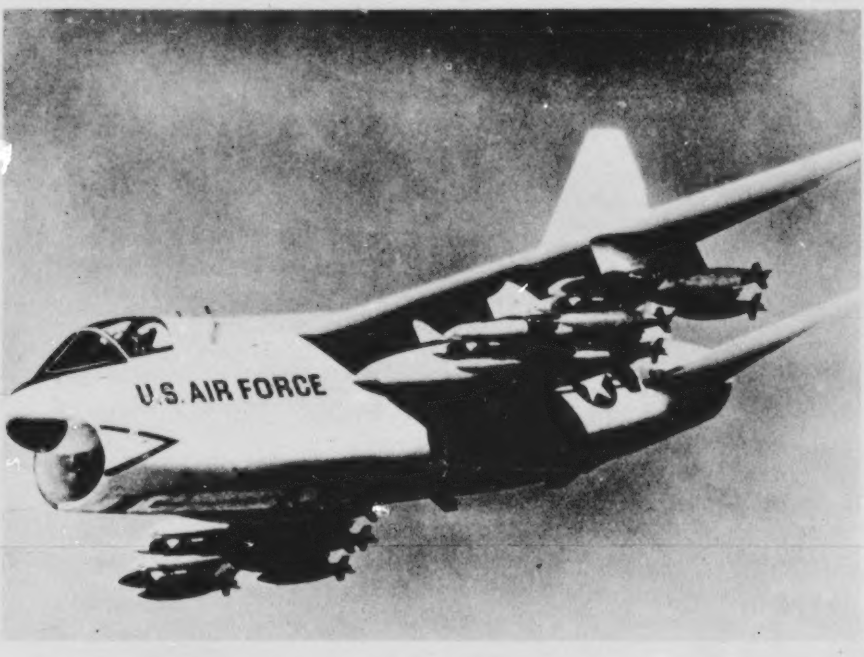

Figure 21. A US Air Force A–7D Corsair.

SPECIAL OPERATIONS AIRCRAFT.—The Special Operations Force uses a wide range of propeller-driven, light jet, and helicopter aircraft for specialized air missions in unimproved landing and operational areas. The T–28 Trojan, A–1E Skyraider, A–37, and the AC–47 Skytrain are strike aircraft adapted to the requirements of counterinsurgency operations. They can operate from small, unimproved landing fields (STOL capability). They can fly "low and slow," when necessary, for greater accuracy in spotting and hitting concealed guerrilla-type targets and loitering over such targets for repeated strikes (Fig 22). Dual flight controls on these aircraft also make them ideal for training pilots of other nations in fighter-bomber operations. The T–28 and the A–37 are modified versions of trainer aircraft.

The gunship, a new concept in close-air and interdiction aircraft, is an adaptation of older cargo aircraft. The C–47 Gooney Bird was modified as a night all-weather gunship. The C–130 was equipped with a number of detection devices ranging from covert sensors to visual illuminators. The success of both the AC-130 and the AC–47 in South Vietnam resulted in the building of a sizeable fleet of gunships. The newest member of the fleet is the AC–119K, with increased capabilities by the addition of

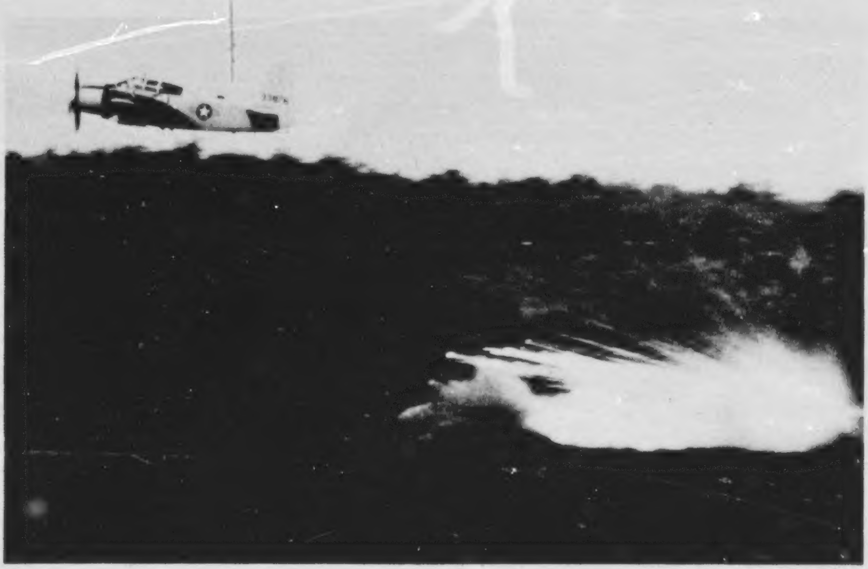

Figure 22. An A–1 Skyraider blasts a Viet Cong position in a jungle of South Vietnam.

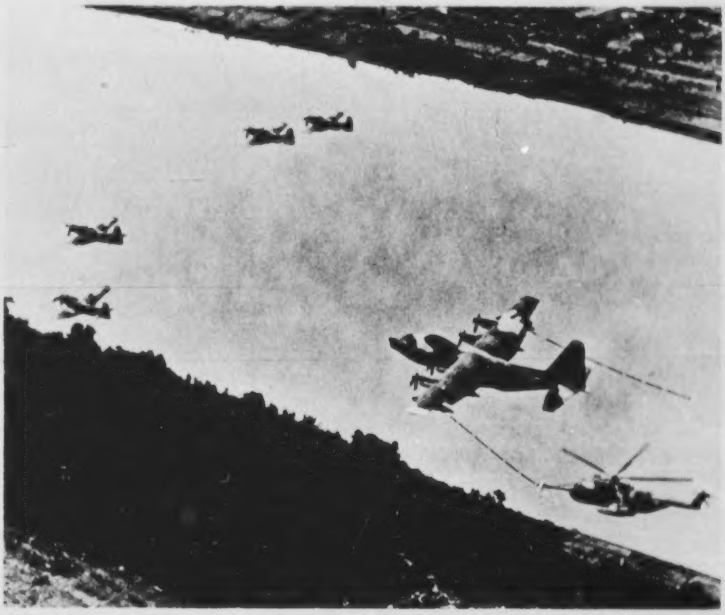

Figure 23. Four Sandy's protect a Jolly Green while it refuels on the way to save a downed airman in SEA.

two jet engines. These aircraft provide a wide range of capabilities in permissive air environments.

An old World War II aircraft, the A–1E, became one of the most valuable aircraft used in Vietnam. Its slow speed long loiter capability, huge ordnance load, and ability to withstand damage made it an ideal aircraft for rescue operations. The pilots of the A–1Es adopted the call sign **"Sandy"** and, for their primary mission, assumed the responsibility of escorting the "Jolly Green" helicopters (HH–3E) in the rescue of downed airmen (Fig 23). The Sandys escorted the helicopters to points near downed airmen and then made the areas safe for the highly vulnerable helicopters to come in for the pickups. Many times, these operations involved hours of dueling with the antiaircraft guns and ground fire surrounding the areas. At times, the Sandys found themselves among the downed, but their efforts were rewarded hundreds of times when they heard the words, "Downed airmen aboard the helicopter, egressing the area safely."

Other special operations aircraft include the U–10, O–2, and OV–10. The U–10 is a single engine utility aircraft used for forward air controlling, visual and photo reconnaissance, resupply drops, light transportation, medical operations, and civic action missions. The O–2 is a light twin-engine aircraft originally designed as a private aircraft but is used as a reconnaissance forward air controller and in psychological operations. The OV–10 is the newest aircraft used in special operations. Designed specifically for foreign internal defense operations, it can be operated as a forward air control aircraft and then perform as a strike aircraft (Fig 24).

RECONNAISSANCE AND OBSERVATION AIRCRAFT.—Reconnaissance aircraft are adaptations of combat planes equipped with cameras and/or electronic equipment rather than armament. These aircraft are indicated by the "R" prefix in combination, such as RB and RF. In special operations, visual reconnaissance is emphasized by the "O" prefix for observation. Other aircraft, indicated by the prefix "E," conduct electronic support activities, and remotely controlled vehicles are becoming available to the tactical air forces.

*Reconnaissance aircraft.*—Two manned aircraft, the RF–4C Phantom operated by both the active and reserve forces and the

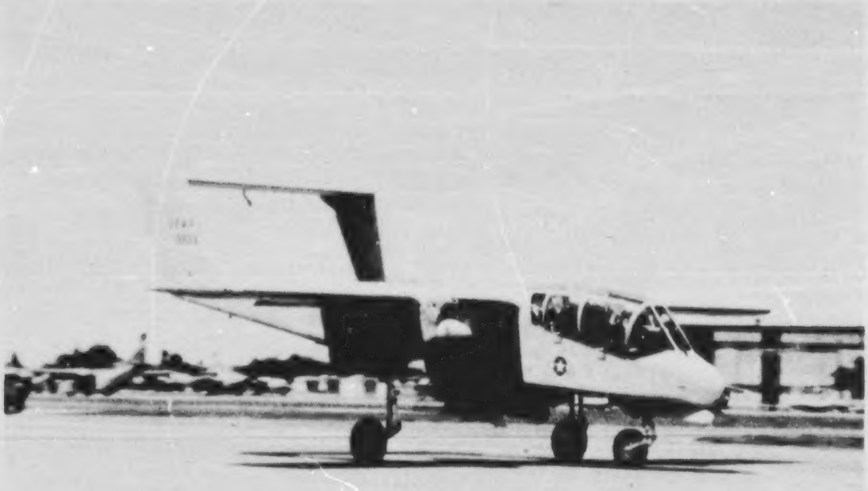

Figure 24. A US Air Force OV–10A forward air control aircraft on take-off roll for a mission in South Vietnam.

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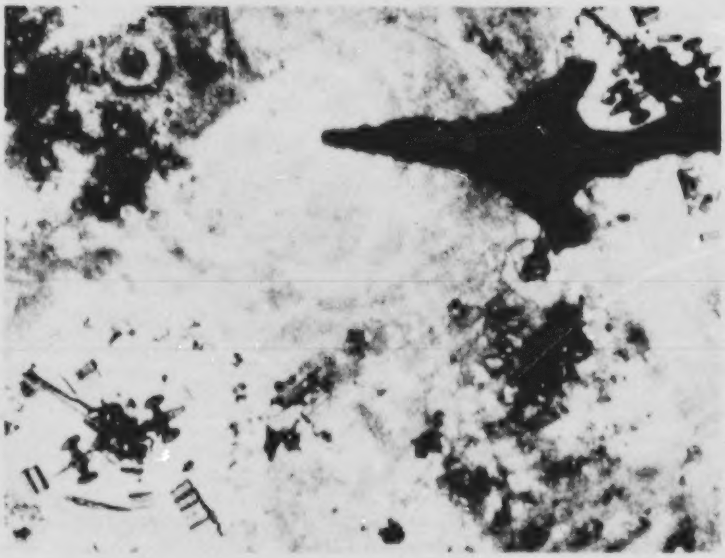


Figure 25. The shadow of RF–101 Voodoo over a North Vietnamese gun emplacement.

RF–101C Voodoo of the reserve forces, are the primary reconnaissance vehicles.

The RF–4C Phantom II is a general purpose reconnaissance aircraft modelled after the F–4C Phantom II tactical fighter. It is a multisensor, all-weather, day/night aircraft manned by a pilot and navigator. Its reconnaissance sensors are mounted in five stations and includes a forward oblique camera, panoramic cameras to cover high and low altitudes and horizon-to-horizon areas, and infrared and laser sensors for day or night reconnaissance. It also has side-looking radar that enables it to record images as far as 30 nautical miles from a target area.

The RF–101C Voodoo is now assigned to the reserve forces, but, for years, it was the mainstay of the active reconnaissance forces (Fig 25). The Voodoo is an excellent day photo reconnaissance aircraft, and it has large internal fuel capacity that enables it to fly long missions without refueling.

The OV–10 Bronco is currently operational for use in special operations reconnaissance. It is a light-armed reconnaissance aircraft that can be equipped for both photo reconnaissance and visual observation.

The EB-66 is equipped for detecting, locating, and classifying enemy electronic countermeasures and for the jamming mission. It is a subsonic aircraft with a combat radius of more than 700 nautical miles with normal fuel loads and even greater distances by refueling.

Also used in the tactical electronic warfare support mission is the AQM-34, an unmanned aircraft launched and directed by the DC-130. This technique is being used increasingly as older manned aircraft are retired.

TACTICAL AIRLIFT AIRCRAFT.—The mission of tactical airlift is to deliver personnel, supplies, and equipment under all conditions and at every level of conflict. The tactical airlift force consists of medium and light transports in varying sizes and performance characteristics. The backbone of the airlift fleet and the most versatile aircraft in the inventory is the C-130 Hercules. In Southeast Asia, where smaller loads had to be delivered to very short airstrips, the C-130 was supplemented by the C-7A Caribou and the C-123 Provider (Fig 26).

The C-130, a four-engine turboprop aircraft, has several advantages: (1) a 20-ton load capacity, (2) quick conversion into a flying hospital, (3) high-speed troop transport, (4) paratroop assault, and (5) the capability of spot-dropping by pushbutton control. The C-130 proved itself at Khe Sanh.

The original C-123 was a twin-engine transport designed to follow the C-119 Flying Boxcar. The C-123K is a modified version equipped with two reciprocating engines and two small jet engines. It usually carries approximately five tons of cargo and can operate into 2,000-foot airstrips. It is used primarily in forward areas to land troops and supplies and to evacuate the wounded. Its airdrop and cargo extraction capabilities, like those of the C-130, are enhanced by its upswept tail, wide rear hatch, and roller-equipped decks.

WEAPONS AND ARMAMENT.—Tactical fighter aircraft carry a full array of air-to-air and air-to-ground weapons. These weapons include tactical nuclear weapons, guided and unguided bombs, missiles, and cluster bomb units (CBUs). Worthy of special mention is the M-61 multibarreled Vulcan cannon or **"Gatling gun,"** which fires up to 6,000 20mm rounds per minute. This high-speed gun solves the problem of delivering an intense concentration of gunfire from a supersonic vehicle. Conventional high explosive bombs, fire bombs, and rockets are still useful, but the most dramatic developments have occurred in guided weapons.

Some of these weapons are discussed under the headings of air-to-air and air-to-ground weapons.

*Air-to-air weapons.*—The AIM-4D Falcon is a modified version of the heat-seeking AIM missiles used by the Aerospace Defense Command. The 130-pound Falcon used by tactical air forces, however, is more effective against maneuvering targets common to tactical air combat.

The AIM-7E Sparrow is a 400-pound radar-guided missile with a high explosive warhead (Fig 27). It has a semiactive guidance system that enables it to home on the radar of enemy aircraft. This weapon is carried partly recessed into the underside of the F-4 Phanton II. A modified version, the AIM-7E-2, has an increased capability to engage maneuvering targets.

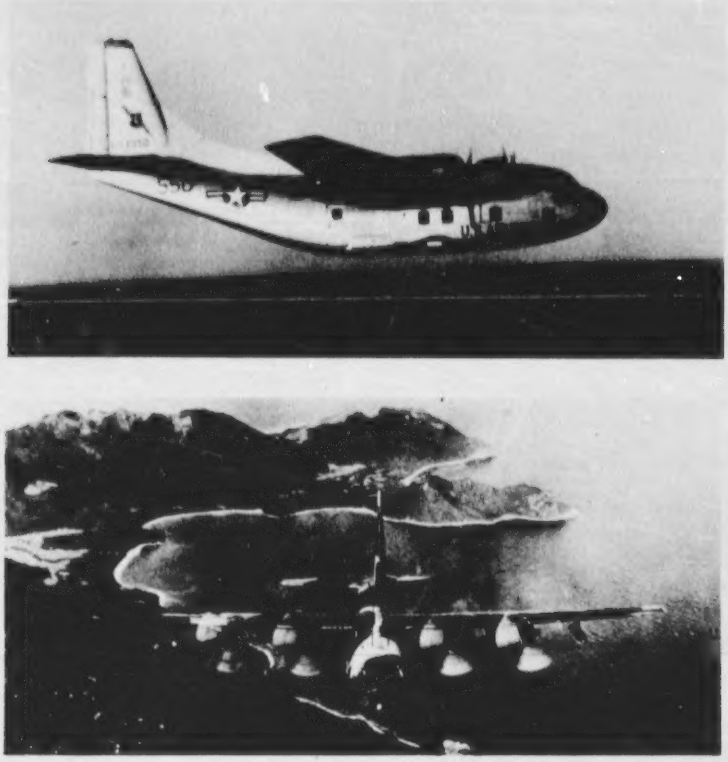


Figure 26. C-123 Provider (above) and C-130 Hercules (below).

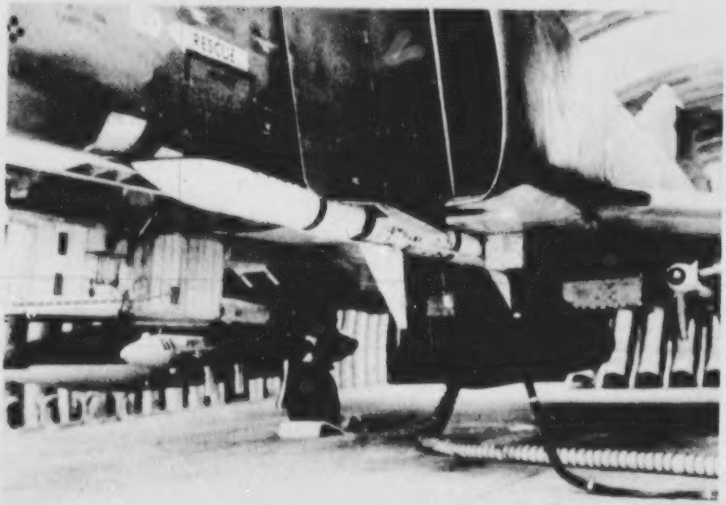


Figure 27. AIM–7 Sparrow missile mounted under a US Air Force F–4 aircraft.

The AIM–9/BE Sidewinder is a 160-pound heat-seeking missile that has been in the TAC inventory longer than any other current guided weapon (Fig 28). It can be carried on all tactical fighter aircraft and requires little training of air and ground crews to operate it. The AIM–9E has a greater capacity than the 9B to destroy moving targets.

*Air-to-ground weapons.*—A wide range of standard bombs can be fitted with laser-seeking or television guidance devices that give these bombs pinpoint accuracy. The laser-equipped weapon seeks reflected laser energy, and the TV device seeks contrasts in the level of light at the target. When equipped with these devices, a single bomb delivered by an F–4 Phantom has produced results against targets that previously required multiple fully loaded aircraft.

The AGM–65/A Maverick is a 500-pound TV-guided missile designed for use against armored vehicles and bunkers. Self-contained guidance and booster capability makes this missile especially useful in standoff attacks against heavily defended targets.

The AGM–45 Shrike is roughly the size of the Sparrow missile and is equipped with a radar-homing system designed for standoff attacks against missile and antiaircraft sites.

The AGM-78 is a missile of more than 1,000 pounds designed for the same function as the Shrike missile, but the AGM-78 has a much greater payload, range, and flexibility than the Shrike. Both missiles are carried by "Wild Weasel" fighter aircraft.

### US Readiness Command

As mentioned earlier, a basic responsibility of the Tactical Air Command is to provide resources to overseas geographic or theater commands. Thus, it is the nature of tactical air forces to team closely with other air, land, and sea forces as elements of unified commands. Unified commands that employ tactical air forces are the US Readiness Command and overseas commands, notably the US European Command and the Pacific Command. Most US Air Force and US Army general purpose forces and substantial Navy and Marine forces serve in varying proportions in these commands, depending upon the current world situation.

With headquarters at MacDill Air Force Base, Florida, the US Readiness Command is the newest unified command and is one of eight unified and specified commands that combine US worldwide military responsibilities into a single network. This command was established in January 1972 to exercise control over general

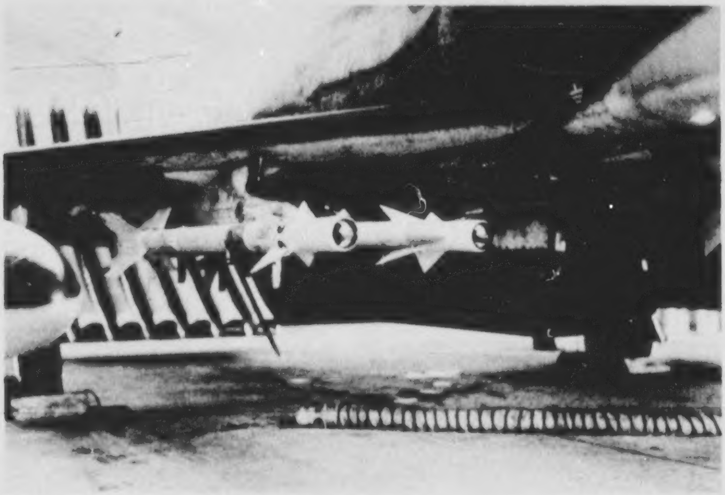


Figure 28. AIM-9 Sidewinder missile mounted under a US Air Force F-4 aircraft.

purpose forces not assigned to other unified commands. It provides a reserve of combat-ready general purpose forces based in the United States to reinforce unified commands overseas.

Headquarters of the command include personnel of all four Services. The joint nature of the headquarters is maintained by assigning officers of all Services, primarily Army and Air Force, in staff positions. For example, of the six staff directors, three are Army officers and three are Air Force officers. In each case, an officer of another Service is the deputy. This joint pattern is employed throughout the subordinate elements of the headquarters.

To fulfill its responsibilities, the Readiness Command draws upon the US-based combat-ready forces of the Continental Army Command and the Tactical Air Command. Tactical airlift requirements for the command are provided by TAC's C–130 Hercules transports and, as necessary, by C–141 Starlifters and C–5 Galaxies of the Military Airlift Command. KC–135 jet tankers of the Strategic Air Command assist in the rapid long-range deployment of tactical fighter and reconnaissance aircraft.

One of the functions of the Readiness Command is to conduct frequent joint exercises to insure its ability to react with credible reinforcements at the first signs of trouble. In this role, the command participates in five types of joint training exercises: (1) command post exercises, (2) brigade and squadron exercises, (3) large-scale exercises at division level, (4) augmenting exercises in support of other unified commands, and (5) exercises in support of the US European Command. In all instances, the objective is to develop and maintain a highly mobile, flexible, and fast reacting joint force for worldwide deployment in the event that it is needed.

PACIFIC AIR FORCES

## PACIFIC AIR FORCES (PACAF)

PACAF is the air component of the unified Pacific Command, which is responsible for all US combat forces in the central and western Pacific, the Far East, and Southeast Asia. With the exception of the Strategic Air Command, all aerospace forces in the Pacific area serve under the PACAF commander. Although, for a number of years, PACAF's activities have centered in Southeast Asia, it is responsible for aerospace operations over a vast area extending from Southeast Asia to Northeast Asia, the Indian Ocean, the Bering Sea, and the entire Pacific Ocean. One-third of the world's population lives in this area under the flags of 35 different countries.

With headquarters at Hickam Air Force Base, Hawaii, PACAF controls an array of strike, tactical, support, and air defense organizations that operate from bases in Japan, Korea, Taiwan, Okinawa, the Marianas Islands, Thailand, Vietnam, and the Republic of the Philippines. PACAF's structure includes three numbered air forces and four air divisions. The numbered air forces are the Fifth Air Force, with headquarters at FUCHU AS, Japan; the Seventh Air Force, with headquarters at Tan Son Nhut AB, Vietnam; and the Thirteenth Air Force at Clark AB, Republic of the Philippines.

For the past 25 years, the Fifth Air Force has been responsible for US aerospace operations in Japan, Korea, Okinawa, and their surrounding seas, an area almost as large as the continental United States. In recent years, much of the tactical air strength formerly based in Japan has been relocated to other bases. Further changes in the Fifth Air Force and its mission are either under way or in the planning stages.

The Seventh Air Force was responsible for US Air Force tactical operations in Vietnam. The commander of the Seventh Air Force also served as Deputy Commander for Air, Military Assistance, Vietnam. As such, he coordinated all Allied air forces in Vietnam.

The Thirteenth Air Force maintains combat-ready units in Thailand, Taiwan, and the Philippines. These units are capable of responding instantly in defense of more than 250 million people in an area almost three times as large as the continental United States. Their mission is to support forces involved in

Southeast Asia, to assist the Philippine armed forces in defending their country, and to provide air defense of Guam and New Zealand.

## UNITED STATES AIR FORCES IN EUROPE (USAFE)

USAFE is another major operational command which draws large concentrations of its tactical air strength from the Tactical Air Command. USAFE serves as the air component of the unified European Command, an international military organization committed to the North Atlantic Treaty Organization (NATO). In addition to USAFE, the European Command includes major Army and Navy commands. Both Army and Air Force components are dispersed among Allied nations throughout Europe.

Headquarters USAFE is located at Ramstein Air Force Base, Germany. The USAFE structure consists of three numbered air forces: the Third Air Force with bases in the United Kingdom; the Sixteenth Air Force, in Spain; and the Seventeenth Air Force, mainly in Germany but with various components throughout Europe. The history of USAFE covers 30 years of continuous air operations over Europe from World War II to its present assignment as a deterrent force in NATO. During this period, it has kept pace with numerous technological and organizational changes. USAFE introduced the first jet aircraft, the F-80 Shooting Star, to Europe in 1948, and its inventory has included F-84s, F-86s, F-100s, F-101s, F-102s, F-105s, C-130s, C-131s, and B-66 tactical bombers. But the introduction of the powerful F-4C Phantom in 1965 began an entire new era of USAFE air power in Europe. Today, USAFE is predominantly a Phantom and F-111 tactical air force, providing NATO with the most awesome commitment of air power in its history.

## WORDS, PHRASES, AND NAMES TO REMEMBER

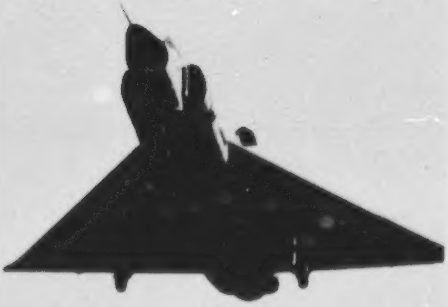
BUFF
chaff
close air support
counterair
electronic countermeasures
Gatling Gun
Hound Dog
HUD
interdiction
Khe Sanh
Minuteman
MIRVS
on the deck
operational readiness inspection (ORI)
Quail
reconnaissance
Sandy
SCAD
SRAM
Strategic Air Command (SAC)
sufficiency of forces
TACS
tactical airlift
Titan II
Wild Weasel

## REVIEW QUESTIONS

1. **How does SAC membership in the Triad insure a sufficiency of deterrent forces for the United States?**
2. **List and describe the resources maintained by SAC to meet its mission requirements.**
3. **What level of command is required to authorize the employment of nuclear weapons against strategic targets?**
4. **What is the difference between SAC's mission and the mission of the Tactical Air Command?**
5. **Is the Tactical Air Command primarily a providing or an employing command? Explain.**
6. **Of the five basic tasks of tactical air forces, which has priority in a combat situation? Why?**
7. **What are the basic aircraft weapons used by Tactical Air Command?**
8. **What is the unique responsibility of the US Readiness Command?**
9. **How does the TAC mission relate to the mission of Pacific Air Forces and United States Air Forces in Europe?**

## THINGS TO DO

1. Make a collection of representative SAC and TAC aircraft and missiles. Your collection might be scale models or pictures for an album. Excellent references for this purpose are such periodicals as *Aviation Week*, *Air Force and Space Digest*, and *The Airman.*
2. Consult your library and other sources and report to your class on some of history's most outstanding tactical airlifts. In your report, you might discuss the reasons for the airlift, the types of aircraft used, types of cargo, difficulties encountered, and the accomplishments.



## Chapter 3

# Operational Major Commands: ADC, MAC, AAC, USAFSO

**THIS CHAPTER continues the discussion of major operational commands begun in Chapter 2. Included is a review of Aerospace Defense Command (ADC), Military Airlift Command (MAC), Alaskan Air Command (AAC), and US Air Forces Southern Command (USAFSO). The chapter explains the missions and operations of these major commands and describes the resources used in the performance of their missions. Major emphasis is given to aerospace defense weapon systems, military airlift activities, and various technical services provided by MAC. The chapter concludes with a brief discussion of Alaskan Air Command and US Air Forces Southern Command and their role in the defense of the Western Hemisphere. After studying this chapter, you should be able to: (1) explain the organization and operation of the continental strategic defense system, (2) discuss the organization of MAC and its worldwide airlift activities, (3) identify the technical services provided by MAC and discuss the functions of each service, and (4) describe the roles of AAC and USAFSO in hemispheric defense.**

THE MAJOR operational commands discussed in Chapter 2 provide strategic offensive and general purpose forces required to wage modern war. In this chapter, we review other major operational commands that perform tasks related to the strategic defense mission or provide airlift and technical services for all US aerospace forces. We first consider the aerospace defense of the North American continent and the role of the Aerospace Defense Command (ADC) in this mission. We next examine the Military Airlift Command (MAC) and its responsibility for global airlift service. Also included are brief discussions of two major commands responsible for the air defense of designated geographical areas: the Alaskan Air Command (AAC) and the US Air Forces Southern Command (USAFSO).

## THE NORTH AMERICAN DEFENSE SYSTEM

In the age of missiles and space weapons, strategic defense, for all practical purposes, means defense against aerospace attack. Thus, defense of the North American continent means aerospace defenses that protect vital US and Canadian industrial, military, and population centers. These defenses include electronic and weapon systems, radar installations, and communications networks designed to cope with threats from aircraft, missiles, and satellites that may approach the continent through aerospace. Responsibility for maintaining and operating these defense systems rests with the North American Air Defense Command (NORAD) and the Continental Air Defense Command (CONAD) and their components, including the Aerospace Defense Command.

### NORAD and CONAD

**NORAD** was established in 1957 with headquarters at Colorado Springs, Colorado. Its task is to defend the continental United States, Alaska, and Canada from aerospace attack. It is the first two-country all-service command to operate on the continent of North America. It is also the first peacetime organization in which the governments of two countries have placed elements of their military forces under the direction of a single commander.

The Commander in Chief, NORAD, is responsible to higher authority in both the United States and Canada. He reports directly to the US Joint Chiefs of Staff and to their Canadian counterpart, the Chief of the Defense Staff. In the commander's absence, his deputy, a Canadian general, assumes responsibility.

The air defense system controlled by NORAD extends across the continent of North America from the polar ice caps to the

Mexican border and from east to west beyond the edges of the continent. To manage this vast system, NORAD divides the continent into regions, each region under a commander responsible for defense operations in his area. Although he reports to the Commander in Chief, NORAD, the region commander has primary responsibility for conducting defense operations within his area. He exercises control through a Semi-Automatic Ground Environment (SAGE) direction center or through one or two Back-Up Intercept Control (BUIC) facilities in the region. These control systems are discussed elsewhere in this chapter.

**CONAD** was originally organized in 1954, prior to the creation of NORAD, as a joint command consisting of Army, Navy, and Air Force units. By action of the Joint Chiefs of Staff in 1959, CONAD became a unified command under a single commander responsible for aerospace defense of the United States. The CONAD commander has complete operational command over all US forces assigned to CONAD, including defense elements assigned to the Alaskan Command. The CONAD commander is the senior US officer in NORAD. Currently, the senior officer is the commander of NORAD (Fig 29). This means that he is the commander of both NORAD and CONAD, but this dual function in no way affects the overall NORAD mission. As NORAD commander, this officer has operational control of US and Canadian

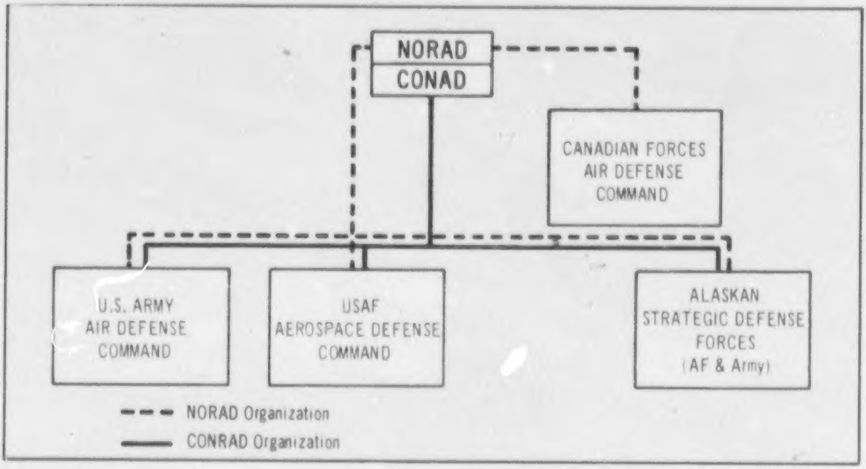

NORAD
CONAD
CANADIAN FORCES AIR DEFENSE COMMAND
U.S. ARMY AIR DEFENSE COMMAND
USAF AEROSPACE DEFENSE COMMAND
ALASKAN STRATEGIC DEFENSE FORCES (AF & Army)
NORAD Organization
CONRAD Organization

Figure 29. NORAD/CONAD command and control structure.

forces and additional operational command authority over US forces. This authority applies particularly to matters of national concern and to classified material on nuclear energy. As NORAD commander, he has the mission of defending the United States, Canada, and Alaska. As CONAD commander, he assumes control of defense operations only in the event that the United States must take action without Canadian participation.

Both Air Force and Army forces of the United States and Canada serve in the NORAD system. However, because of its specialized capabilities in aerospace, the US Air Force provides a major share of NORAD's operational elements. Therefore, as the Air Force component of NORAD, the Aerospace Defense Command is the largest and most significant member of the NORAD organization.

**Aerospace Defense Command.**—The Aerospace Defense Command conducts its activities through an organization geographically the same as the NORAD regions. That is, it provides forces to NORAD for continental defense according to the designated NORAD regions. NORAD systems operated and maintained by ADC include the following:

- Ballistic Missile Early Warning System (BMEWS)
- Distant Early Warning (DEW) Line
- Sea-Launched Ballistic Missile (SLBM) Detection and Warning network
- Spacetrack network of radar and optical sensors
- Over-the-Horizon (OTH) forward-scatter radar detection system
- Airborne Early Warning and Control (AEW&C) system

The above systems are discussed in some detail under weapons and operations. In addition to these systems are ADC's SAGE and BUIC centers and fighter squadrons. Also an element of ADC, the

14th Aerospace Force, manages the surveillance, warning, and operational forces concerned with the ballistic missile and possible space threat. Since ADC provides the major share of NORAD's resources, it is also responsible for organizing, training, and administering these forces. It then places them under the operational control of NORAD and the operational command of CONAD for use in the continental defense system.

Besides organizing, training, and equipping defense forces, ADC formulates aerospace defense doctrine and tactics employed by Air Force units. It also joins with the other Services in developing unified doctrine for the defense of the United States.

In addition to active duty units in ADC, Air National Guard (ANG) forces operate in a full-time partnership with ADC under the control of NORAD. ADC organizes and trains these units in much the same manner as their active duty counterparts. At the beginning of the 1970s, 16 fighter interceptor units of the ANG were trained and equipped with F-101, F-102, and F-106 all-weather interceptor aircraft for use by NORAD.

US ARMY AIR DEFENSE COMMAND.—The US Army Air Defense Command is a major component command under Headquarters NORAD. Like the Aerospace Defense Command, the Army maintains its headquarters in the vicinity of NORAD headquarters. It performs planning functions and places Army units in tactical air positions according to procedures established by the Commander in Chief, NORAD. The Army contribution to NORAD includes Nike-Hercules and Hawk surface-to-air missiles, together with their radar and control systems.

CANADIAN FORCES.—The Canadian Forces Air Defense Command (CFADC) has two headquarters: one headquarters at North Bay CFADC Station deals entirely with operational matters, and another at Ottawa performs planning and support functions. Canada places all of its CF-101 interceptor units under NORAD control. These units perform essentially the same training and surveillance tasks as their US counterparts. The CF-101 aircraft is basically the same aircraft as the US Air Force F-101.

### The Role and Mission of Aerospace Defense

In its broadest sense, the mission of aerospace defense is to defend a nation, an area, or specific targets against attacks by aircraft, missiles, and space weapons. Two fundamental tasks of the nation's military forces are to deter military aggression or action not in the interests of the United States and, in the event that deterrence fails, to conduct warfare while limiting damage to the United States. Defensive forces of the Aerospace Defense Command play a key role in the performance of these tasks in conjunction with the offensive forces discussed in Chapter 2.

DETERRENCE.—A nation's ability to deter aggression depends upon its economic, political, and military strength; its determination to use its strength; and the attitude and judgment of potential enemies. Defensive forces are vital elements of the nation's overall strength. A potential enemy must prepare to face a mixture of manned and unmanned weapon systems in an attack on the United States. The presence of highly proficient defensive forces also demonstrates the willingness of the United States to defend itself. Of even more importance are statements by the President that the United States will maintain these forces as long as the manned bomber and ballistic threat exists. Such statements are reflections of the national will to use force against these threats.

A critical part of the deterrence concept is the attitude of a potential enemy toward the nation's strength. If an enemy doubts that the nation will use its strength, he may be encouraged to undertake aggressive action. On the other hand, strong defensive forces may cause an enemy to doubt the capability of his offensive forces. Are his forces capable of penetrating the defense system? If so, to what degree? Does he have sufficient forces to absorb heavy losses and still strike a decisive blow? A credible defense system forces him to consider the quantity and quality of his forces before he launches an attack. And as defensive forces improve their capability, he must continually increase his offensive capability. This means that he must accurately estimate his opponent's capability and then develop sufficient forces to overcome the opponent. Defensive forces also deny a potential enemy the element of surprise. The tactical warning system maintained by the United States insures the ability to retaliate before an enemy attack can destroy US offensive forces.

These are the foundations of the deterrence concept, and defensive forces make vital contributions to the deterrent effort. However, if an enemy is not deterred from launching an attack, these forces must be prepared to perform a second major task—damage limitation.

DAMAGE LIMITATION.—Because of the variety of weapons available to a potential enemy, the best possible defense system cannot turn back or completely destroy a determined enemy attack. However, a defensive capability must be developed and maintained to limit the damage from an attack to the lowest possible level. In an all-out attack, the United States will probably suffer tremendous losses—millions of lives, numerous major cities, and military and government control systems. Nevertheless, the nation's defense system must constantly improve its capability to protect its people, its military offensive forces, its industries, and other resources. The offensive forces are especially important. They must survive an attack with the capability of destroying the aggressor nation. The defense system provides security in three ways: tactical warning, passive defense, and active defense.

The Joint Chiefs of Staff define **tactical warning** as "a notification that the enemy has initiated hostilities. Such warning may be received any time from the launching of the attack until it reaches its target." The tactical warning system consists of far-flung radar networks and other electronic devices. This system provides a warning that can range from as little as 15 minutes for a ballistic missile attack to two hours for a manned bomber attack. Limited warning time requires offensive forces to employ airborne and ground alert, hardening, dispersal, and other measures. Although warning time is extremely limited, it is the element of security necessary for alerting the offensive and defensive forces and initiating passive defense measures.

**Passive defense** includes such noncombat measures as the dispersal of military, economic, and population resources to limit the targets available for the enemy to attack. Passive defense is not a specific NORAD responsibility; the various military commands are responsible for their own passive defense. Measures already taken to harden and disperse SAC air bases and missile sites are examples.

Civil defense is an important part of the passive defense effort to reduce the effects of an enemy attack upon the civilian population. The civil defense program is also concerned with emergency conditions following an attack. It includes planning and training to perform emergency repairs and to restore power, transportation, communications and other utilities destroyed by enemy action. Identifying, building, and equipping emergency shelters and instructing the public on the use of the shelters are important aspects of the civil defense program.

Once tactical warning of an enemy attack is provided, **active defense** becomes the most important activity. After the enemy launches his attack, the only obstacles between his force and its target are the defense forces. These forces must engage the enemy forces as far as possible from their targets and continue to attack them as they proceed to the targets. In other words, active defense consists of direct defensive measures to destroy or reduce the effectiveness of an enemy attack.

### ADC Weapons and Operations

Our discussion thus far has centered on the organization of the North American defense system and some of the concepts applied in its operation. Now, we consider this system in more concrete terms, that is, as a vast network of interconnecting command posts joined to an operations center and equipped with modern communications devices, computers, automatic display boards, and weapon systems.

Command and Control.—An earlier section emphasized the importance of centralized control in the operation of a continental or global defense system. Also mentioned was the fact that centralized control of NORAD forces begins at the Combat Operations Center (COC), Headquarters NORAD. This COC operates in the world's most bombproof installation deep in the heart of **Cheyenne Mountain** near Colorado Springs, Colorado. It is a completely hardened site capable of withstanding almost any type of nuclear attack. A solid granite shield at least 1,200 feet thick protects the main installations of the center; these installations can be reached only by narrow tunnels burrowed deep into the side of the mountain. Two 30-ton steel doors guard these tunnels from blast waves. Inside this vast man-made cavern are several steel buildings resting on coil springs. These buildings serve as the operating headquarters of the COC.

The COC is operated by ADC personnel and is the control point for NORAD's manned bomber defense system and the space detection and tracking system; it also receives inputs from BMEWS and the satellite-tracking system. Through this system, the NORAD commander receives automatic inputs from all parts of the detection and warning system. Computers collate and analyze the information and then present it in visual form on projection display panels. This system provides almost instant information on aircraft approaching the North American continent, suspicious submarines off the coast, the status of interceptors, and other defense weapons across the continent (Fig 30). Other inputs include weather data, the status of the Strategic Air Command and other armed forces, and the deployment of hostile forces and their degree of military readiness. Through an interlocking system, information on the NORAD display panel is shown simultaneously to the Commander, Strategic Air Command, the US Joint Chiefs of Staff, and the Canadian Chiefs of Staff Committee.

In the event of an attack, this center is prepared to perform three vital functions: (1) provide tactical warning to retaliatory forces and the civilian population, (2) direct remaining defense resources after an attack gets under way, and (3) insure the most effective use of forces engaging enemy weapons. Vital links in the ADC command-and-control system are the Semi-Automatic Ground Environment (SAGE) system, the Back-Up Interceptor Control (BUIC) system, and an Airborne Warning and Control System (AWACS) under development.

*Semi Automatic Ground Environment (SAGE) System.*—**SAGE** direction centers provide an automated and computerized capability for almost instant response. The system is known as a "semi-automatic ground environment" system because it permits

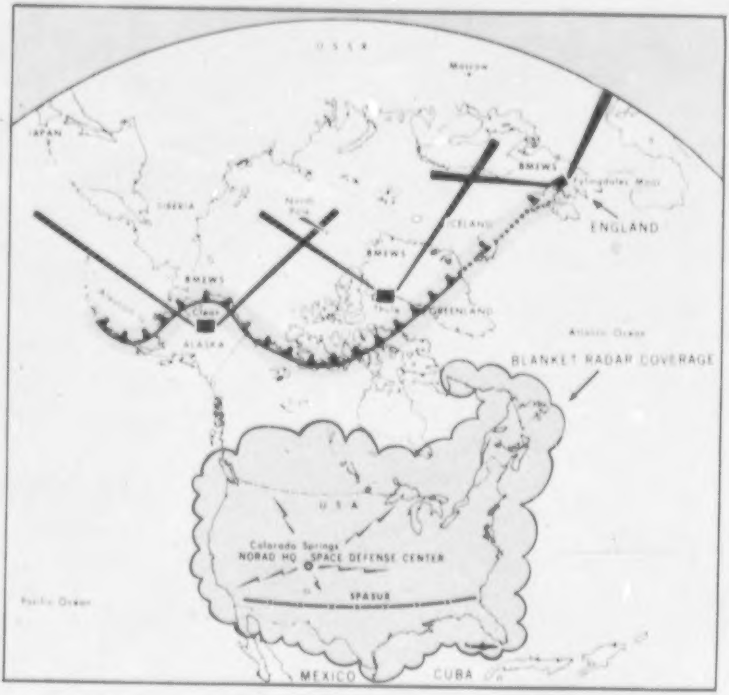

U S S R
Moscow
JAPAN
SIBERIA
North Pole
BMEWS
Fylingdales Moor
ENGLAND
ICELAND
BMEWS
BMEWS
Clear
ALASKA
Thule
GREENLAND
Atlantic Ocean
BLANKET RADAR COVERAGE
U S A
Colorado Springs
NORAD HQ
SPACE DEFENSE CENTER
SPASUR
Pacific Ocean
MEXICO
CUBA

Figure 30. NORAD detection and tracking systems.

voice communications, manual inputs of information, and human decision making in controlling and directing the defense system. The term "ground environment" indicates that the center is located on the ground and is not an airborne command post. These centers are connected by a variety of communications systems to all of their sources of information, including the COC, NORAD radar networks, and the Federal Aviation Agency. Weather data from civil and military sources, flight plans, and information on the status of defense weapons are fed into a data processing system capable of 65,000 computations per second. This system can receive, store, and analyze data and record answers in microseconds. The direction center receives all information necessary for making decisions; after decisions are made, the center can then employ the defense weapon system against an enemy attack.

Each direction center is housed in a windowless building of blast-resistant concrete. In the center of the building is a two-story pit, which serves as the command post for the region commander. Directly in front of the commander and his key staff officers is a large screen on which a complete air battle can be projected. With the push of a button, the commander can view a display of an air battle within his region or in other NORAD regions. Or he may select a smaller area in his region if he wishes to monitor it in more detail.

*Back-Up Interceptor Control (BUIC).*—Since SAGE direction centers are not located at completely hardened sites, they are probably priority targets for an enemy attack. **BUIC** provides an alternate system of direction centers in the event that a SAGE installation is destroyed. This back-up system insures continuity of command and control and computerized interceptor operation if parts of the SAGE system cannot function.

Late in 1972, all BUIC sites except Tyndall Air Force Base, Florida, were reduced to a standby status with minimum staffing. The cutback in the operational staff resulted from budget limitations. BUIC sites can resume operational status for a limited period with the use of standby maintenance personnel who can be augmented or relieved in a short period by personnel from other active installations.

*Airborne Warning and Control System (AWACS).*—For 26 years, ADC has relied on several basic tools to fulfill its air defense mission. These tools include a far-flung radar network for surveillance, a command and control system to analyze radar data and direct air battles, and a weapon system to intercept and destroy an enemy attack. But, with continuing improvements in offensive weapon systems, modernization of the ADC defense system is necessary. The Airborne Warning and Control System, under development, is a vital part of the ADC modernization effort.

**AWACS** aircraft will carry radar equipment capable of monitoring wide areas currently reached by fixed radar sites of more than 100 men each. And, with a look-down capability, AWACS will overcome a present advantage available to an enemy if he chooses to make a low-level approach toward North American borders. Additionally, a command and control staff will operate in these aircraft. This means that the AWACS will become, in effect, the airborne equivalent of the current SAGE and BUIC centers. It will combine the computer capability of SAGE with the survivability, mobility, and range of an airborne platform (Fig 31).

AWACS will not be required to remain in the air at all times. It offers the option of activation by another element of ADC's modernization program—an **over-the-horizon backscatter radar (OTH-B).** ADC and the Air Force are currently developing the OTH-B into an operational system. With this system, ADC can launch its interceptors and AWACS aircraft to meet an enemy attack as far as possible from North American borders. The

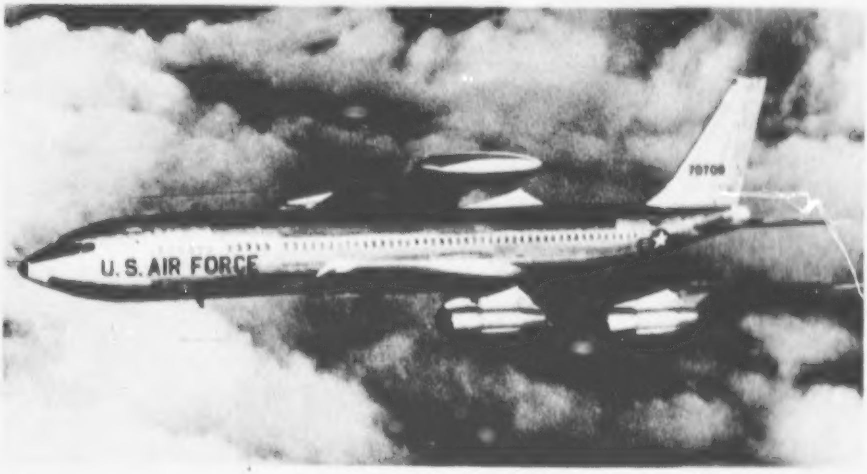


Figure 31. AWACS aircraft extend the range of the North American warning system.

OTH-B system uses the reflective properties of the ionosphere to reflect radar beams. These beams, in turn, will detect approaching aircraft at far greater distances than conventional radars. Used in conjunction with AWACS aircraft, OTH-B will greatly improve the range of ADC's current radar system.

DEFENSE AGAINST MANNED BOMBERS.—The Aerospace Defense Command performs four basic actions or functions in protecting the North American continent from a manned bomber attack. These functions are detection, identification, interception, and destruction.

*Detection*.—The major parts of the system for detecting manned bombers are the Distant Early Warning (DEW) line and an overlapping radar system of land and airborne radar installations. An attack over the north polar regions would first be detected by DEW line radars. The **DEW line** is a 3,600-mile chain of radar stations extending from the Aleutian Islands in the Pacific, across the top of North America to the eastern side of Greenland; they are flanked on the east by the Greenland-Iceland-United Kingdom warning system. This line effectively covers all approximately direct routes from Soviet Europe or Asia to important US-Canadian target areas. A hostile bomber force attempting to "end run" around this lengthy perimeter would find the trip both time- and fuel-consuming.

An enemy attack approaching southern Canada would enter an area of continuous radar. This system blankets Alaska, southern Canada, and much of the United States. Until a few years ago, two inner radar fences across Canada supplemented the DEW line. These were called the Mid-Canada line and the Pinetree Line. The Pinetree sites are now incorporated in the contiguous radar coverage, where new installations of increased power now have enough northward range to make the Mid-Canada line unnecessary. The prime and gap-filler radars of the contiguous coverage provide high- and low-altitude coverage. Any aircraft flying within the area is observed by one to four radar stations at all times.

In addition to its use for detection and warning, this system also serves as the eyes for the control system that directs defense weapons in an air battle. However, it has a capability against the manned bomber threat only; it is not designed for use against the ballistic missile threat.

*Identification*.—When an object has been detected, ADC and NORAD must find answers to these questions: What is it? Is it a known aircraft on an approved flight plan? Is it an aircraft that is not following its planned flight because of an emergency? Is it a friendly aircraft, or is it a hostile aircraft? The longer it takes to identify the object, the less time there is for reacting. This means that possible hostile aircraft must be rapidly sorted out from a heavy flow of normal civil and friendly military air traffic over the North American continent.

Each day, more than 200,000 flights take place within the NORAD area. Even with the help of SAGE, daily identification of each of these flights would be physically impossible. NORAD devotes major attention to civilian and military aircraft that cross the continental perimeters or national borders. It provides the heaviest radar coverage on these perimeters and along the DEW line and designates these areas as air defense identification zones **(ADIZ).**

Before an aircraft may enter an ADIZ, the pilot must prepare and submit for approval a flight plan, indicating the route and time and place of zone entry. This is forwarded by the responsible civil or military authority to the defense system, where it is programmed into the SAGE computers so that it can be displayed at the appropriate time and compared with the track of the actual flight. If the two tracks compare within the allowed tolerances, the flight is assumed to be friendly. Anything irregular brings on a radio query to the aircraft in question, followed if necessary by a very rapid cross check with appropriate civil or military authorities. Experienced defense personnel have ways of determining hostile intent by track behavior. Certain changes in direction and altitude or other maneuvers suggest an effort to avoid or confuse the defense system. A number of tracks converging on a prime target area would also arouse suspicion. This is the principal method of identification known as *flight plan correlation.*

Another method involves the use of electronic devices called **transponders** to identify aircraft. These devices are provided on most US military aircraft and some civilian aircraft. Under a system that employs a selective identification feature, aircraft equipped with these devices can transmit transponder signals that appear as distinct identifying signals on the ADC radarscopes.

Finally, if all other means of identification fail to produce a satisfactory answer within minutes, the aircraft is classified as "unknown," and a swift manned interceptor is scrambled to identify it visually by type and nationality. This situation happens within NORAD several times a day.

*Interception and destruction.*—These functions begin after detection and identification functions have been completed. If an aircraft is identified as hostile, the next tasks are to intercept and destroy it. The manned weapon systems available to NORAD, all provided by ADC, include interceptor aircraft and the air-to-air weapons with which they are armed.

The oldest interceptor in the ADC inventory is the delta-winged F–102A. It was the first supersonic, all-weather interceptor and one of the first to be equipped with the data-link communication system, which enables it to receive radar-computerized guidance from the ground. The F–102 can reach speeds over mach 1 and an altitude of 50,000 feet, but it can launch missiles with even higher operational altitudes. It is presently armed with Falcon missiles, the AIM–26B and the AIM–4A and –4C. The F–102 is used by regular forces in the air defense of several overseas locations, but, within NORAD, this aircraft has been assigned to Air National Guard squadrons (Fig 32).

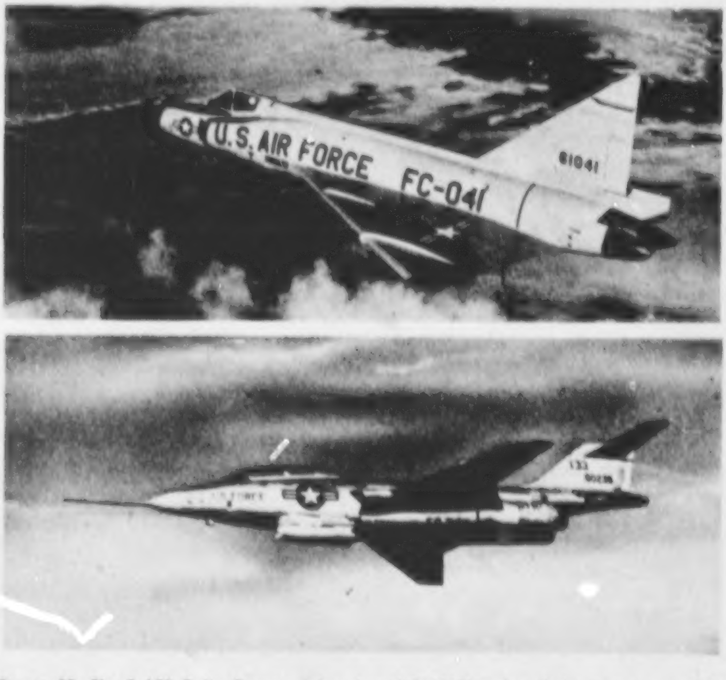


Figure 32. The F–102 Delta Dagger (above) and F–101 Voodoo (below) are two ADC interceptors flown by the Air National Guard.

The next all-weather interceptor, the F–101B, is an interceptor that carries a two-man crew—a pilot and radar observer. The F–101 can reach a top speed over mach 1 and an altitude over 50,000 feet. It is armed with the AIM–4D missile and the nuclear AIR–2A rocket. All F–101B interceptors used by ADC forces in NORAD are assigned to the Air National Guard (Fig 32).

The F–106A resembles the F–102, but the F–106 is the fastest, highest flying, most advanced interceptor in the ADC inventory. It has a speed over mach 2 and a combat radius over 700 miles. It is also capable of in-flight refueling. This interceptor can carry four AIM–4F or AIM–4G missiles and one AIR–2A nuclear rocket. Its data link system with SAGE is even closer than that of the F–102. The ground controller can steer it out to the intercept point by means of its autonavigational system while the pilot focusses his attention on weapons rather than navigation. Even weapon firing is highly automated. The pilot selects the weapon, locks the radar onto the target, and presses a "trigger" which does not fire the weapon instantly but lets a computer determine the precise instant to fire. The F–106 is flown coast-to-coast entirely by autonavigation, with the pilot making only the takeoff and landing (Fig 33).

Armament used by interceptors has advanced over the years from machine guns to cannons, to rockets, and, finally, to guided air-to-air missiles. Although cannons and multiple small rockets are still useful as reserve weapons, interceptors today depend on

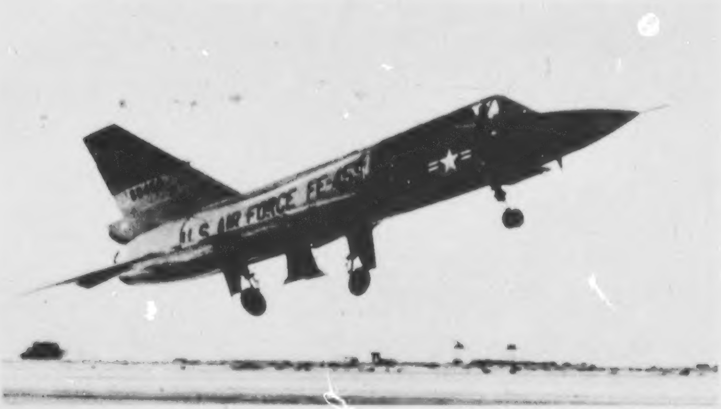


Figure 33. The F–106 Delta Dart is the most advanced interceptor in the ADC inventory.

larger rockets and missiles to accomplish their intercept-and-destroy mission. The AIR–2A Genie, for example, is an 800-pound ballistic rocket with a nuclear warhead and a range of six nautical miles. This rocket must fly a straight course to its target, but its mach 3 speed and warhead make it an effective weapon even against maneuvering targets.

The latest airborne intercept missiles (AIM) carried by defense interceptors are, perhaps, better known as Falcon missiles. These missiles were designed to overcome the disadvantage of the ballistic weapons. The Falcons have self-contained guidance systems that operate either by radar or infrared (heat-seeking) guidance. AIM–4A and –4B are radar-guided versions of the Falcon. These missiles carry a small radar antenna which receives energy bounced off the target by the interceptor's radar. AIM–4C, –4D, and –4G are infrared versions and are less vulnerable to electronic countermeasures than the radar-guided series. However, since these are heat-seeking missiles, weather conditions may reduce heat signals from the target or other objects may give off similar heat signals. Such conditions adversely affect their guidance systems. More recent radar-guided AIM–4Fs and infrared –4Gs have improved guidance systems, new rocket motors, mach 2 launch speed, and increased countermeasures. The flexibility of the AIM–26B adds further support to the family of weapons concept. It has a conventional high-explosive warhead and can be carried in mixed loads with the AIM–4A or –4D.

The AIMs have several advantages over previous interceptor weapons. They can be launched miles from the target, follow maneuvering targets, and climb above the interceptor's operating altitude.

In addition to the airborne intercept missiles, two types of unmanned surface-to-air missiles support the concept of terminal defense—the Nike-Hercules and the Hawk. The Nike-Hercules uses solid propellants in both booster and sustainer motors. It has a 75-mile range and can reach an altitude of 100,000 feet plus. It has destroyed drone targets flying at more than three times the speed of sound. It can have either a high-explosive or nuclear warhead. The HAWK (homing-all-the-way killer) is a surface-to-air missile developed especially to counter the enemy aircraft attempting to come in low to escape radar surveillance. It is a radar-homing weapon (that is, it is drawn toward the radar of an enemy aircraft), and its guidance system is highly capable of discriminating against ground clutter.

DEFENSE AGAINST MISSILES AND SPACE WEAPONS.—The basic functions of detection, identification, interception, and destruction also apply to missiles and space weapons. In addition to defense against the air-breathing threat represented by the manned bomber, ADC must be capable of defending against intercontinental ballistic missiles (ICBMs), sea-launched ballistic missiles (SLBMs), and satellites in orbit. At this writing, however, the nation's defenses against missiles and space weapons are far from complete. ADC has effective surveillance systems in operation, but it does not have a complete weapon system. A partial antiballistic missile weapon (ABM) is scheduled for completion in 1974, and a limited capability has been developed to intercept and destroy hostile orbiting satellites.

*Detection of ICBMs.*—ADC maintains two systems to detect ICBMs: the ballistic missile early warning system (BMEWS) and the 440-L Over-the-Horizon (OTH) radar. BMEWS is a separate radar system designed to provide warning of a ballistic missile attack approaching North America over the north polar regions. Like the OTH-B radar mentioned earlier, the OTH-440-L radar employs a technique that reflects a beam of radar energy off the ionosphere to detect any disturbance caused by the launching of a missile.

Since an ICBM must follow a predetermined course, its path in the early part of its flight determines the path that it follows in the remainder of its flight. Therefore, if two radar fixes can be obtained early in the flight, computers can predict when and where the ICBM will land. For this purpose, ADC, for several years, has maintained three giant radar installations located at Clear, Alaska; Thule, Greenland; and Fylingdales Moor, England (Fig 34). (The Royal Air Force operates the Flyingdales radar, with ADC liaison.) Their principal physical features are fixed antennas as large as football fields, 400 feet long and 165 feet high, backed up by huge globe-shaped scanner/tracker radars. These installations and their rearward communications system constitute BMEWS.

BMEWS has a detection capability that extends approximately 3,000 miles into space. It is oriented to detect missiles launched on a northerly course over the Arctic Circle. It is a warning system only and has no capability to defend against incoming missiles. A BMEWS radar emits its beams in two large, flat, fan-shaped spreads, one above the other. Therefore, a missile launched from an Asian or European site must pass through these

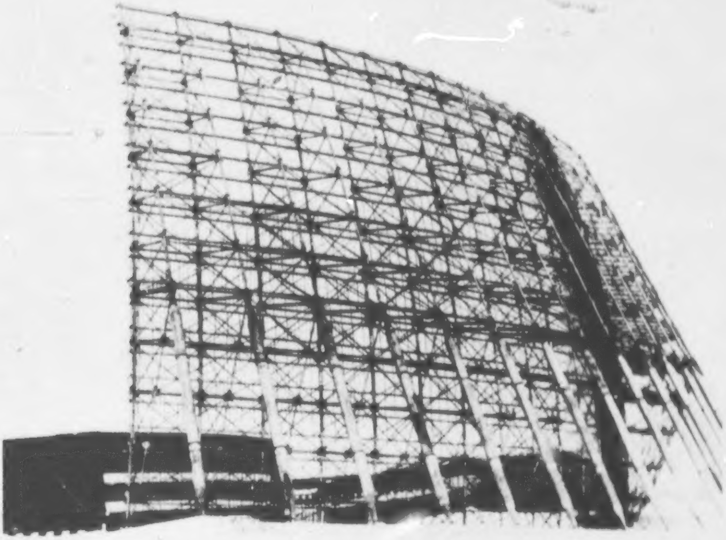


Figure 34. A BMEWS antenna at Thule AFB, Greenland.

two overlying fans. In the process, the radars provide two fixes to the computers, which, in turn, determine the missile's trajectory, its approximate impact area, and the time remaining until impact. If its destination is a North American target, its intent is hostile. If it is heading into orbit or outer space, its intent is still undetermined. The Space Defense System, another ADC detection system, must then take over surveillance of the missile. This information is displayed almost instantly in the NORAD Combat Operations Center, SAC Command Post, the National Military Command Center (NMCC), the alternate NMCC, and the Canadian Defense Staff Command Post.

BMEWS alone provides warning time of 15 minutes. However, with the addition of the 440-L Over-the-Horizon (OTH) radar capability, BMEWS warning capability has been extended to approximately 30 minutes in the event of an ICBM attack. Previously, radar detection was limited to line of site along the horizon. However, by reflecting radar signals off the ionosphere, the OTH system can detect missiles far beyond the horizon within seconds of launch and at distances of several thousand miles. This system not only increases warning time of an ICBM attack but also provides warning against Extended Range Ballistic Missiles launched at North America from the south.

*Detection of sea-launched missiles and orbiting satellites.*—A new system operated by ADC is the sea-launched ballistic missile (SLBM) detection and warning network. The purpose of this system is to detect ballistic missiles launched from submarines toward the coast of North America. From seven sites on the Atlantic, Pacific, and Gulf Coasts, the SLBM system provides warning capabilities for the eastern, western, and southern approaches to the continent.

The NORAD Space Defense System (SDS) is responsible for detecting and tracking orbiting satellites. This system includes the NORAD Space Defense Center (SDC), the Space Detection and Tracking System (SPADATS) and the Satellite Intercept System (SIS). However, the SIS also has interception and destruction capabilities and is described under space weapons.

The space threat includes two basic possibilities. A weapon sent aloft as an orbiting satellite can be given a signal that will suddenly change its course and direct it toward a North American target. It is also possible that a future orbiting space platform will be capable of launching a weapon toward the earth. Since the first satellite launch in 1957, more than 4,000 objects have been detected in space, and this number will increase as the United States, the Soviet Union, and other nations continue to explore space. All of these objects are not active satellites. In fact, most of them are "space debris"—boosters, tankage, fairings, and other odd pieces that have accompanied their payloads into orbit. The Space Defense Center processes 300,000 to 400,000 observations of these objects each month.

The NORAD Space Detection and Tracking System receives data from four primary sources: the US Air Force Spacetrack System, BMEWS, the US Navy Space Surveillance System (SPASUR), and the Canadian Armed Forces Air Defence Command Satellite Tracking Unit. Additional data is available from the National Aeronautics and Space Administration, the Air Force Eastern Test Range, Western Test Range, and Pacific Missile Range.

NORAD's primary detection and warning network is the US Air Force **Spacetrack** system operated by ADC. Spacetrack receives data from a multitude of electronic and optical devices located throughout the world. The electronic devices include both search and tracking radars capable of detecting objects as small as one square meter in size many thousands of miles in space. Optical devices, such as the giant **Baker-Nunn camera,** can pinpoint objects over 20,000 miles in space.

The newest addition to the Spacetrack system is the FPS-85 radar near Eglin Air Force Base, Florida. This is a "phased array" radar capable of following multiple tracks of satellites, missiles, and even manned aircraft. This radar requires no rotation and serves as a detection and tracking system many times faster and more versatile than older radar systems. Almost all orbiting objects pass through its viewing field at least twice each day.

*Interception and destruction.*—Presently, the United States has only a limited capability to defend against the missile and space threat. Following lengthy debate, Congress has provided funds for development of the **Safeguard** antiballistic missile system. This system consists of the Sprint and Spartan ~~missiles,~~ including radars and centralized computers to coordinate them and deliver firing signals to the weapons (Fig 35). Radars for these weapons are the Perimeter Array Radar (PAR) for early warning and tracking and the Missile Site Radar (MSR) located at the site of the defense missile for tracking an incoming missile as it approaches its target.

The **Spartan** missile is a fast-reacting three-stage solid propellant missile which is capable of intercepting an ICBM in space several hundred miles out from its target and destroying or neutralizing it by means of the radiations emitted from its exploding nuclear warhead. The other missile, even faster in its reaction, is called the **Sprint** (Solid Propellant Rocket Interceptor). It has a two-sage solid propellant motor. It also has a nuclear warhead and is designed for closer-range intercept of enemy missiles that get past the Spartan.

As mentioned earlier, the NORAD Space Defense System contains a Satellite Intercept System operated by the US Air Force. This system employs the **Thor** missile. If a decision is made to intercept and destroy a satellite considered to be a threat to national security, CONAD would use this system although it has only a limited capability.

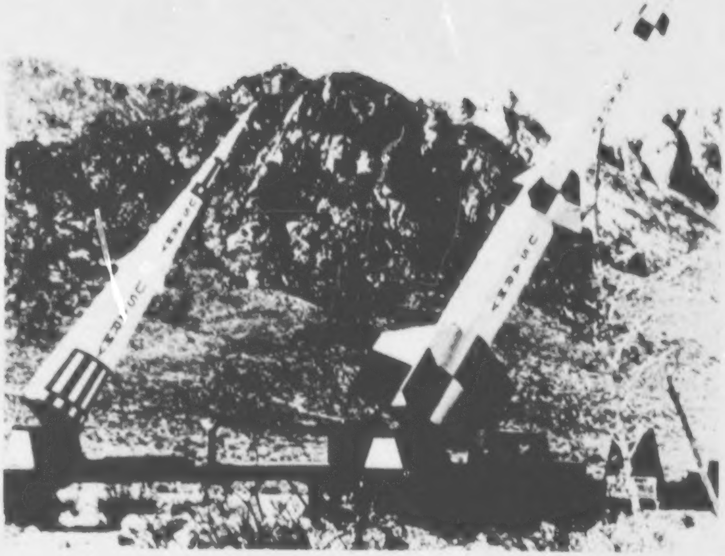


Figure 35. Safeguard ABM system: Sprint (L) and Spartan (R) missiles.

## THE MILITARY AIRLIFT COMMAND (MAC)

This major command provides air transportation of personnel and cargo for all the military services on a worldwide basis. It maintains the Air Force strategic airlift forces and exercises command over specialized airlift units and four technical services.

### The Beginnings of Military Airlift

The Military Airlift Command acquired its present name in 1966, but, even before then, it performed global airlift and technical missions under other names. It actually began in World War II as the Air Corps Ferrying Command with the mission of transporting aircraft, personnel, and mail to the United Kingdom. During the early months of US participation in World War II, this was the most important means of delivering much needed air power across seas infested with enemy submarines. In mid-1942, the Ferrying Command became the Air Transport Command (ATC). It then assumed the airlift mission and the responsibility for developing overseas air routes, bases, and facilities.

Soon ATC was in the global airlift business in a big way, with routes to Alaska; direct to England by way of the North Atlantic; roundabout to England by way of Brazil and the South Atlantic; and across Africa, the Middle East, and India, and, ultimately, to China. The Navy established a similar service across the Pacific. These routes were flown by two-engined C–47s and C–46s, and four-engined C–54s and C–87s. The C–87 was a converted Liberator bomber; the other three were adapted from commercial passenger plane designs. The most dramatic ATC wartime exploit was known as **The Hump**—a steady airlift over a 500-mile route from eastern India into China over Japanese-occupied areas of Burma and China. The hazards of the Hump included high Himalayan mountain peaks, wild jungle terrain in the valleys between, heavy monsoon weather, and, when the weather cleared, Japanese fighters.

After World War II, ATC continued to maintain its global routes on a reduced scale. In 1948, the newly-created US Air Force consolidated ATC and naval and other Air Force elements into a new command, the Military Air Transport Service (MATS). This was the name under which the command traveled from 1948 through 1965. Hardly had MATS been created when a European crisis brought on the effort called the Berlin Airlift (described in Chapter 1). The airlift itself was conducted by USAFE and allied air forces, but MATS helped to get it started by rushing in men and aircraft to augment it, and then maintained a supporting transatlantic airlift. A few months' breathing spell after the Berlin Airlift was followed by the outbreak of hostilities in Korea in June, 1950, which stepped up traffic across the Pacific. MATS has been continuously busy since then, maintaining steady passenger and supply routes to globally deployed US military forces as well as moving in with force in emergencies demanding major airlift efforts. From Antarctica to Thule, Lebanon to Taiwan, the Congo to Vietnam, the dramatic exploits of MATS and MAC have been written in history.

The MAC technical services have had a fascinating history of their own. There has been a considerable amount of reshuffling—moving organizations into and out of the command. For instance, the Air Force Communications Service, now a major command, was a part of MATS until 1961. Originally, the emphasis of the MATS services was on route and flight service in support of the main airlift mission. As a motorist uses road maps, signs, and markers to guide him along the highways, so a pilot uses charts, communications, and weather information to guide him over the airways. Today, these services are still essential, but some have been transferred out of MAC, and those that remain in MAC include many Air Force-wide and military services-wide support functions, including tasks in support of nuclear, space, and other scientific projects.

## MAC Organization and Resources

All MAC activities are conducted from the headquarters at Scott AFB, Illinois (Fig 36). The overall mission of MAC is to maintain a global airlift service as distinguished from tactical airlift described in the preceding chapter. As a rule, MAC provides transoceanic airlift from the United States into overseas areas, or within overseas areas, in peace and war. Tactical airlift, on the other hand, operates within a theater of action, such as Vietnam, from port of debarkation to battlefront and otherwise prepares for combat airlift tasks; it does not perform day-to-day support functions.

NUMBERED AIR FORCES.—MAC's major airlift effort is conducted through two numbered air forces: the 21st Air Force, with headquarters at McGuire Air Force Base, New Jersey, and the 22d Air Force, with headquarters at Travis Air Force Base, California. The 21st Air Force conducts airlift operations throughout the North Atlantic, Europe, Africa, and South America. The 22d Air Force conducts airlift operations in the Pacific and Far East. The Mississippi River is the dividing line between these two air forces' areas of responsibility in the United States. On the other side of the world, these areas are separated at the 90th meridian east, near Calcutta, India.

These two air forces supervise the MAC airlift mission and maintain facilities to meet any national emergency. They also coordinate the services of all air transport agencies and airlift aircraft available to the US Government. The MAC airlift system reaches from the United States to any point in the world where US forces are located. The range and speed of modern aircraft enable them to use any aerial port in the United States for any overseas destination.

SPECIALIZED WINGS.—Special airlift organizations include a "special missions" wing, an airlift training wing, and an aeromedical airlift wing. The 89th Military Airlift Wing, Special Missions, based at Andrews Air Force Base, Maryland, flies the Air Force **Spirit of 76,** a 707 commercial type of airliner with the military designation VC–137. This is a passenger aircraft reserved for the President, cabinet members, foreign heads of state, and other high-ranking officials. The wing uses C–135B and C–118 aircraft for long-range operations and smaller VC–140 Jetstars and various propeller-driven aircraft for special domestic missions. The 443d Military Airlift Wing Training, based at Altus Air Force Base, Oklahoma, provides advanced aircrew training in C–141 and C–5 aircraft.

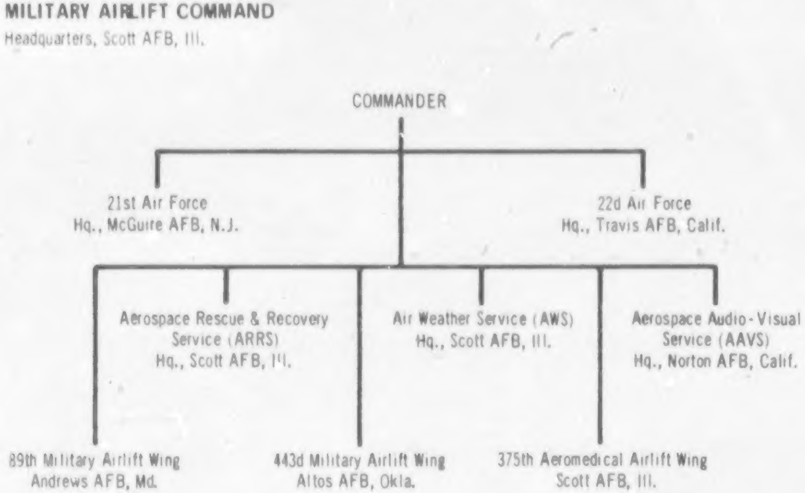

MILITARY AIRLIFT COMMAND
Headquarters, Scott AFB, Ill.
COMMANDER
21st Air Force
Hq., McGuire AFB, N.J.
22d Air Force
Hq., Travis AFB, Calif.
Aerospace Rescue & Recovery Service (ARRS)
Hq., Scott AFB, Ill.
Air Weather Service (AWS)
Hq., Scott AFB, Ill.
Aerospace Audio-Visual Service (AAVS)
Hq., Norton AFB, Calif.
89th Military Airlift Wing
Andrews AFB, Md.
443d Military Airlift Wing
Altos AFB, Okla.
375th Aeromedical Airlift Wing
Scott AFB, Ill.

Figure 36. Military Airlift Command organization.

The 375th Aeromedical Airlift Wing, based at Scott Air Force Base, Illinois, flies hospital aircraft carrying sick and wounded patients of all military services to and between military hospitals throughout the United States. Its fleet of C-9 hospital aircraft also provides connections with the transoceanic C-141 aircraft operated by the 21st and 22d Air Forces. This wing forms the last link in an aeromedical evacuation chain that reaches into the most remote battlefield or station in the world. This means that a sick or wounded serviceman is no more than a day or two from medical attention in a stateside hospital if such treatment is necessary.

AIR RESERVE FORCES.—During emergencies, Air Force Reserve and Air National Guard forces are additional resources available to MAC. Air Force Reserve units are equipped with C-124 aircraft, and Air National Guard wings are equipped with C-121 and C-124 aircraft. Through a **Reserve Associate Program,** MAC trains Reserve forces in the use of active airlift aircraft and in the performance of airlift support functions.

CIVIL RESERVE AIR FLEET (CRAF).—Commercial airlines organized as the **Civil Reserve Air Fleet** also augment MAC's regular airlift forces. In addition to carrying a part of the day-to-day military air traffic, CRAF maintains aircraft earmarked for emergency use under MAC control if a total national airlift capability is required. The conflict in Vietnam, for example, required increased activity by MAC, CRAF, and Air Reserve units. Bulk cargo and passenger requirements beyond the capability of the military airlift force determine the number of aircraft in the CRAF.

BASE ENGINEER EMERGENCY FORCE (PRIME BEEF).—This is a base-level program that provides civil engineers for combat support to the Air Force mission. **Prime BEEF** provides for civil engineering recovery and mobile support teams at each base. Eight mobile support teams operate within MAC. Five BEEF-C teams are trained to support special operations forces and unforeseen contingency operations. Three BEEF-F teams are available to precede or move with a flying unit wherever it may be deployed.

## MAC Operations

At first glance, military airlift requirements may appear to be those primarily concerned wih tactical operations, that is, operations within a combat theater. However, the effectiveness of tactical forces depends upon the global airlift capability of the United

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States. MAC's strategic airlift mission is to fulfill this requirement. To accomplish this mission, it must maintain an effective command and control system, highly organized airlift forces, and up-to-date equipment.

COMMAND AND CONTROL.—Overall command and control of MAC's global airlift force is exercised by the Headquarters MAC Command Post at Scott Air Force Base. Command posts of the numbered air forces supervise the operations necessary for accomplishing each airlift mission. At each MAC base and at other bases used by MAC aircraft, base airlift command posts are responsible for onloading, launching, and offloading airlift aircraft passing through their stations. This network of command posts, from headquarters to local bases, enables MAC to respond rapidly and effectively to day-to-day airlift requirements. It also permits MAC to respond to emergency requirements in a minimum of time.

The communications network used in the MAC command and control system consists of record communications provided by medium- and high-speed AUTODIN terminals. This is an automatic digital system that, within minutes, transmits messages concerning the movement of airlift aircraft throughout the world. Voice communications within the MAC control system are transmitted by means of AUTOVON (automatic voice switching network). MAC uses an IBM 1410 computer to store operating data on arrivals, departures, and load information pertaining to all airlift flights. This data is recorded from within 15 minutes to two hours after each event and provides almost instant management information for command and control purposes.

Another important part of MAC's ability to meet airlift requirements rapidly and effectively is the Airlift Control Element (ALCE). The ALCE is a team of highly skilled operators and support technicians who can be flown on short notice to any area of the world. These technicians provide on-site command and control of the airlift operation, including loading, crew control, and maintenance services.

STRATEGIC AIRLIFT OPERATIONS.—In contrast to tactical airlift, strategic airlift is the continuous or sustained air movement of personnel and materiel between area commands, between the United States and overseas areas, and within an area command. MAC's primary mission is to deliver combat forces and their equipment anywhere in the world. For example, the buildup of US Armed Forces in Southeast Asia, beginning in 1965, brought tremendous requirements for the airlift of troops, patients, cargo, and mail. To meet these requirements, MAC began using the C-141 Starlifter for airlift operations into the area. By 1966, the C-141 had demonstrated its capability with the airlift of 3,000 troops and almost 5,000 tons of equipment from Hawaii to Pleiku, Vietnam, in only 17 days. In November 1967, MAC undertook the largest and longest military airlift ever attempted into a combat zone. With a fleet of C-141s and C-133s, it airlifted 10,024 troops and 5,357 tons of equipment of the 101st Airborne Division from Fort Campbell, Kentucky, to Bien Hoa, Vietnam.

During February 1968, MAC demonstrated the value of strategic airlift in a contingency situation. With no warning and little time for preparation, it deployed Air Force, Army, and Marine combat units to Korea and Vietnam. These moves fulfilled urgent needs for forces in Korea and Vietnam resulting from the Pueblo incident and the 1968 Viet Cong Tet offensive. In that one month, MAC moved more troops, passengers, patients, and tons of cargo than had been moved in any previous month in airlift history.

In addition to its combat airlift mission, the MAC airlift force engages in readiness exercises of various sorts. For example, in such annual exercises as Reforger/Crested Cap, it demonstrates its ability to support the North Atlantic Treaty Organization with troops based in the United States. It airlifted 15,500 Army and Air Force personnel from the United States to Germany in 1969, more than 13,000 in 1970, and 11,000 troops and 1,000 tons of cargo in 1971. In March 1971, C-141 Starlifters airlifted 800 combat-equipped paratroopers from Pope Air Force Base, North Carolina, to the Republic of Korea. This exercise was one of history's longest parachute assault operations—8,500 miles.

The airlift force is frequently used to relieve suffering caused by natural disasters. Like its combat role, its humanitarian role has been global in scope. It played a major role in typhoon-swept Guam in 1962; Pakistan during a severe drought in 1964; the Alaskan earthquake in 1964; and the Arizona blizzard of 1967. MAC aeromedical aircraft evacuated patients from a Veterans' Administration Hospital in Mississippi during Hurricane Camille in 1969 and from a US Naval Hospital in Corpus Christi, Texas, during Hurricane Celia in 1970. In December 1972, the conflict in Vietnam was reaching a climax, and a maximum airlift effort was necessary in that area. Also during December 1972, the Central American city of Managua, Nicaragua, suffered a disastrous earthquake. Within hours, MAC had airlifted emergency medical teams, equipment, and supplies to the troubled city. MAC accomplished this humanitarian mission while it was exerting a major effort in Vietnam. These and numerous other airlift missions demonstrate the versatility and flexibility of MAC's airlift fleet in emergencies wherever they may occur—on the battlefield or in relief missions.

THE AIRLIFT FLEET.—The regular MAC fleet consisted of 525 aircraft at the end of 1967, 483 at the end of 1968, and 340 at the end of 1971. Although the number of aircraft decreases, MAC's total ton-mile capacity increases because of the steady replacement of older propeller-driven aircraft with larger and faster jets. However, most of the older aircraft have not been retired from service. They continue to serve MAC and TAC in Air Force Reserve and Air National Guard air transport units.

The C–141 Starlifter is considered the backbone of MAC's acive airlift fleet, but it was joined in 1969 by the C–5 Galaxy, the world's largest aircraft. Together, the C–141 and the C–5 comprise an airlift team unsurpassed in the history of military airlift. The C–141 cruises at more than 500 miles per hour and can carry as much as 65,000 pounds of cargo (palletized loads, small vehicles, and helicopters) or 154 troops. It has a multipurpose interior that can be rapidly adapted for aeromedical evacuation, missile airlift, cargo and troops, or the movement of patients from overseas areas to hospitals in the United States (Fig 37).

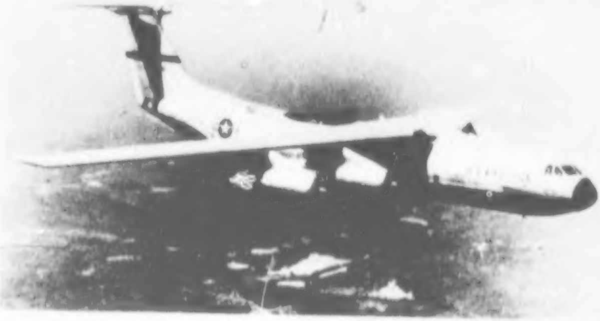


Figure 37. C–141 Starlifter.

The C–5 Galaxy complements the C–141 (Fig 38). If a load is too large or heavy for the C–141, the C–5 can take over. The C–141 can carry 65,000 pounds of standard-size cargo, but the C–5 has an outsize capability for 256,000 pounds. This means that it can airlift the largest Army battle tank (M–60), two Huey helicopters, five armored personnel carriers, and three trucks with trailers. It can carry this load 1,500 miles and return without refueling. The C–5 aircraft has a front- and rear-loading capability that permits rapid loading and unloading. Other features include a short takeoff and landing capability, inertial navigation, an all-weather airdrop navigation system, and a system that detects and reports maintenance problems while the aircraft is airborne.

Formerly, the C–117 Liftmaster, a four-engine troop and cargo aircraft, and the C–131 Samaritan, a two-engine aircraft, made up MAC's domestic and European aeromedical fleets. These older reciprocal types have been replaced by the C–9 Nightingale (Flying Hospital), a twin-jet, medium transport (Fig 39). This is a high-speed, long-range aircraft that contains specially designed equipment for complete airborne medical care. A significant feature on this aircraft is the special care unit, which has its own humidification, air conditioning, and ventilation system. Patients with communicable diseases and other patients requiring special care can be treated by trained medical crew members in this unit. During 1971, the C–9 moved almost 50,000 patients to 534 medical facilities in the United States.

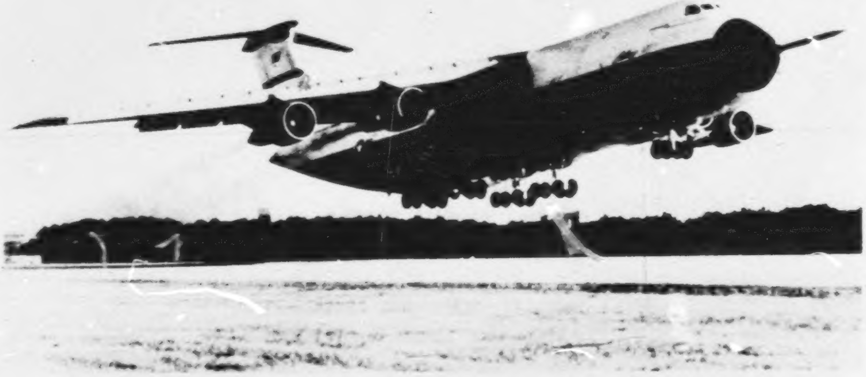


Figure 38. C–5 Galaxy.

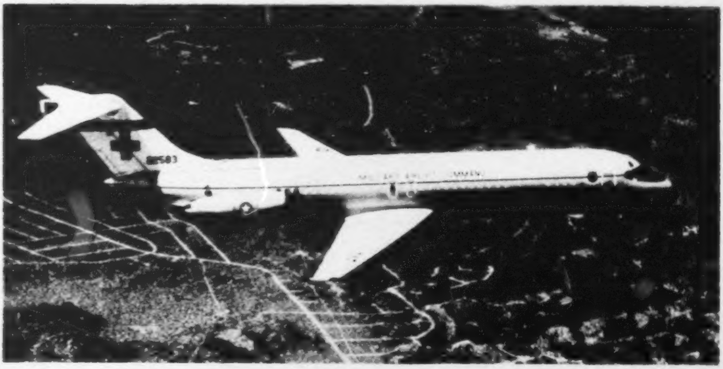


Figure 39. A MAC C-9A medical evacuation aircraft in flight.

### MAC Technical Services

The technical services performed by MAC for the Air Force and other Government agencies are assigned to four subordinate organizations: the Aerospace Rescue and Recovery Service (ARRS), the Air Weather Service (AWS), and the Aerospace Audio-Visual Service (AAVS).

Aerospace Rescue and Recovery Service (ARRS).—With headquarters at Scott Air Force Base, Illinois, the ARRS provides worldwide rescue service to the Air Force, other military services, and, under certain circumstances, civilian activities. Within the continental United States, it is responsible for the direction and control of all inland search and rescue operations. In this capacity, it directs the search efforts of the Civil Air Patrol, the National Guard, the Navy, the Coast Guard, and all local law enforcement agencies. ARRS also provides aircrew recovery for all incidents involving Air Force aircraft. This task involves locating, rendering aid to, and retrieving aircrew personnel from friendly or hostile lands in peace or war. ARRS assists civil aviation of the United States, upon request, and it provides assistance to civil and military aviation of other countries according to procedures established by the International Civil Aviation Organization and the policies of the Department of Defense.

ARRS also provides a variety of rescue services not directly related to the military mission. For example, in 1969, it aided over 2,500 people during and after a flood in Tunisia. It provided rescue service during Hurricane Camille, and, on four separate missions, it has rescued Russian seamen. Presently, ARRS, the US Army, the Department of Transportation, and other Government agencies are working jointly on a project known as Military Assistance to Safety and Traffic (MAST). This is a civilian emergency medical assistance program that provides air transportation for victims of highway accidents.

ARRS has rescued more than 22,000 people and has provided assistance to 85,000 people involved in accidents. Of 733 people saved by ARRS in 1971, 431 were civilians. Of the total saved, 143 came from combat areas in Southeast Asia.

Among the most courageous and highly decorated men in Southeast Asia were ARRS personnel who flew the HH-3, HH-43, and HH-53 helicopters known as the **Jolly Green Giants** and the "Super Jolly Green Giants." Supported by the Sandys, mentioned earlier, and HC-130 aircraft as refueling and airborne command posts, these men flew the "Jolly Greens" into heavily defended enemy territory to rescue downed flyers. Pararescuemen on board the "Jolly Greens" left their aircraft and dropped into the jungle to aid wounded airmen. On numerous occasions, they spent the night in hostile territory to tend downed airmen until they could be rescued (Fig 40).

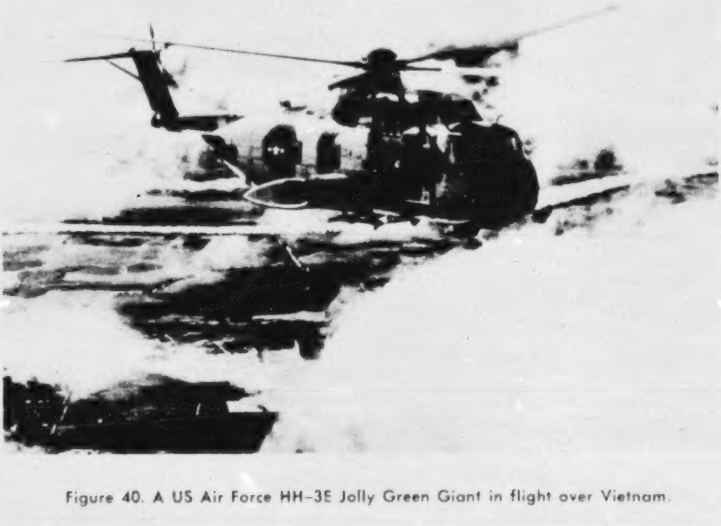


Figure 40. A US Air Force HH-3E Jolly Green Giant in flight over Vietnam.

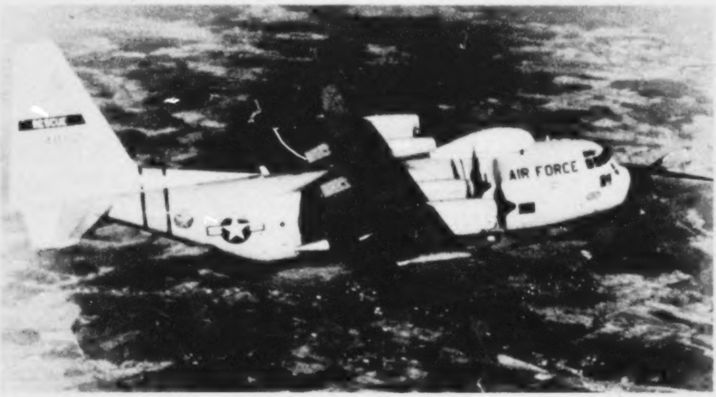


Figure 41. A US Air Force HC–130H.

ARRS has become increasingly involved in space age activities. One of its tasks, in support of the National Aeronautics and Space Administration, is to fly Hercules HC–130 aircraft specially equipped for the midair capture of capsules ejected from satellites as they parachute toward the earth from space (Fig 41). Rescue of astronauts after they splash down at sea is a well-known ARRS mission. An outstanding example of ARRS capability is the prompt rescue and recovery of the Gemini 8 astronauts and spacecraft after their unscheduled splashdown in the Pacific in March 1966.

Air Weather Service (AWS).—The AWS is the largest of the MAC technical services. It has its headquarters at Scott Air Force Base and, like the ARRS, functions on a worldwide basis. Its mission is to provide specialized weather service to the Air Force and the Army and to civil weather bureaus in the United States and other countries.

AWS activities include operation of aerial sampling and weather reconnaissance units throughout the world. In support of scientific projects, AWS conducts both balloon and rocket soundings of the upper atmosphere and takes samples of the atmosphere for radioactive contamination. Data gathering and analyzing equipment available to AWS include Tiros satellites, which take pictures of cloud patterns over large areas of the world and transmit them to ground stations for analysis and forecast purposes, computers for analyzing masses of global weather data or past weather history, radar, and instruments for instant recording and transmission of weather information.

AWS has detachments stationed at Air Force bases and operates other fixed or mobile ground stations at selected observation points. These detachments provide weather forecasts for pilots in transit and for those flying locally. The detachments are organized in larger units, such as squadrons, groups, and wings. The units in the United States are not set up by geographical areas but are organized according to the commands they support, whether in a few localities or nationwide. In this way, weather service can be specialized or tailormade according to the needs of the command. Each of the major commands discussed in this text —SAC, ADC, TAC, area commands, support commands and MAC itself—needs a different kind of weather service. It may call for a computer-equipped central forecasting facility for analyzing the continental or global weather picture for SAC. It may call for development of mobile observing units and rapid transmission of up-to-the-minute local weather for tactical operations; or it may call for special scientific projects in support of research conducted by the Air Force Systems Command.

Other AWS activities include severe weather warning and the difficult job of forecasting solar flare activity. AWS combat weather teams can be paradropped with brigade-level Army units to provide on-the-spot weather advice to the field commander. Each day, from the tropics to the polar regions, AWS makes thousands of weather observations with equipment ranging from unsophisticated thermometers to complex electronic instruments. All AWS activities aim at one objective—reliable weather advice for military decision makers.

AWS uses the WC–135 and WC–130 aircraft to perform its weather reconnaissance and air sampling missions. Included in their operations are storm searches and penetrations and weather modification missions to dissipate fog near airport terminal areas. The WB–57F aircraft is used to perform the AWS high-altitude radiation sampling mission.

AEROSPACE AUDIO-VISUAL SERVICE (AAVS).—The only nonflying service within MAC is the Aerospace Audio-Visual Service. This service operates at worldwide locations to manage and program all Air Force photos and motion pictures. For example, films used by AFJROTC are developed and supplied by this agency. AAVS also provides film coverage of all missile launches. AAVS activities span the globe, producing combat and technical motion picture and still photography, training films, and television products for a variety of purposes that range from weapons evaluation to news releases. The AFJROTC film "No Where to Go But Up" was produced by AAVS. Space programs expanded both the photomapping and photographic functions of AAVS. On 15 May 1963, AAVS photographed a Mercury shot at Cape Kennedy from an aircraft for the first time. Other services rendered by AAVS include documenting all nuclear tests and joint training exercises and assisting in tests sponsored by the Atomic Energy Commission and NASA.

As part of the combat team, AAVS was responsible for all Air Force photography in Southeast Asia except reconnaissance and photo mapping. AAVS technicians loaded and processed film used in fighter aircraft gun cameras. At times, MAC combat photographers also flew in strike aircraft, using handheld cameras to obtain combat footage. AAVS provided valuable services in documenting combat action, evaluating weapons, and training aircrews.

## ALASKAN AIR COMMAND (AAC)

AAC, the oldest USAF major command, is the Air Force component of the unified Alaskan Command. The AAC commander is senior adviser to the Commander in Chief, Alaska (CINCAL) concerning the appropriate employment of aerospace power. He plans, conducts, and coordinates tactical air operations, including tactical airlift support within Alaska as required or directed by Headquarters USAF. The Alaskan Air Command also provides combat-ready aerospace defense weapon systems, aircraft warning and control elements, and air defense forces for the Alaskan-NORAD Region. It is the air arm of defense for the northernmost approaches to the continental United States, some 50 miles away from the Soviet Union.

AAC operates from two main bases in Alaska—Eielson Air Force Base near Fairbanks and Elmendorf Air Force Base, Headquarters AAC, near Anchorage. Bases at King Salmon and Galena serve as forward operating bases for command and control of air defense interceptors. It also maintains remote installations for air defense and tactical air operations. Some of these installations serve as NORAD surveillance stations, and the others serve as interceptor control centers for defense against manned bombers.

In addition to its aerospace defense mission, AAC has a number of other missions, including search and rescue, airlift, and support operations in Greenland. Under the guidance of its Rescue Coordination Center, the command has saved the lives of more than 2,329 Alaskans and has assisted 6,000 other Alaskan residents. AAC's 17th Tactical Airlift Squadron performs the major part of the command's airlift mission—transporting Army units. AAC units provide the only physical link between DEW stations on the Greenland ice cap and the outside world.

### US AIR FORCES SOUTHERN COMMAND (USAFSO)

Another major command is the US Air Forces Southern Command, with headquarters at Albrook Air Force Base, Panama Canal Zone. It is the air component of the unified US Southern Command operated under the direction of the Joint Chiefs of Staff. USAFSO has a geographical area of responsibility second in size only to that of PACAF. More than two times the size of the continental United States, this vast area reaches from the southern border of Mexico to the southern tip of South America.

The primary mission of USAFSO is to promote the security and solidarity of the Western Hemisphere. This mission includes the air defense of the Panama Canal Zone and technical assistance in training Latin American air forces. Also included in its mission are various civic action programs and humanitarian services. USAFSO engages in frequent joint training exercises with other US Services and with Latin American Allies, but it devotes major efforts in providing airlift training, equipment, and technical assistance to the Latin Americans. Because of these activities, USAFSO has become best known as a goodwill ambassador in Latin America.

USAFSO has made important contributions in the development of Latin American transportation networks, flood relief projects, and relief programs for victims of earthquakes. Not only have C–130s and C–123s transported roadbuilding equipment to construct new highways; the command has also undertaken extensive flood relief projects in Panama, Costa Rica, and Colombia and has airlifted numerous supplies into the remote interiors of Bolivia. One of its most noteworthy efforts in recent years has been its massive relief program for earthquake victims in the Chimbote area of Peru in 1970.

Another important USAFSO function is the training of Latin American officers and airmen at the Inter-American Air Forces

Academy, Albrook Air Force Base. Although the courses are similar to those taught in the United States, they are modified to meet the needs of Latin Americans.

## WORDS, PHRASES, AND NAMES TO REMEMBER

ABM
active defense
ADIZ
AWACS
Baker-Nunn Camera
BMEWS
BUIC
Cheyenne Mountain
Civil Reserve Air Fleet
CONAD
Dew line
Jolly Green Giants
NORAD
over-the-horizon backscatter radar
passive defense
Prime BEEF
Reserve Associate Program
Safeguard
SAGE
Spacetrack
Spartan
Spirit of '76
Sprint
tactical warning
The Hump
Thor
transponders

## REVIEW QUESTIONS

1. **What is the relationship of the Aerospace Defense Command to NORAD? What is the scope of the NORAD air defense system?**
2. **What is the twofold task of aerospace defense forces? How are these tasks related?**
3. **Describe the basic components of the North American air defense system —command and control, aircraft, and weapons.**
4. **What are the regular components of the MAC organization? What provision is made to augment MAC's regular airlift forces during emergencies?**
5. **Cite some examples to illustrate the types of airlift operations conducted by MAC.**
6. **List and describe the aircraft that comprise MAC's airlift fleet.**
7. **Compare MAC's airlift function with that of tactical airlift forces.**
8. **What are some typical technical services provided by MAC in addition to its airlift activities?**
9. **In what ways do the Alaskan Air Command and the United States Air Forces Southern Command contribute to the defense of North America and the Western Hemisphere?**

## THINGS TO DO

1. Report on MAC's newest aeromedical aircraft, the C–9A, and its newest cargo aircraft, the C–5. Give such details as the size and design, significant technical features, and special accommodations. If possible, accompany your report with pictures.
2. Develop a map of North America showing the location of early warning radars, air bases, and missile installations that comprise the North American air defense system.
3. Organize a student panel to discuss the issues involved in the deployment of an antiballistic missile (ABM) system. Points to be considered should include: the location of the sites; the effect of an ABM program on the arms race between the United States and Russia; the deployment of a "thin" system as opposed to a "heavy" system; and whether any type of ABM system would have sufficient defense capability to justify its cost.

## *Chapter* 4

# Support Major Commands and Separate Operating Agencies

THIS CHAPTER describes the missions and functions of the Air Force support commands and separate operating agencies. Major emphasis is given to the Air Force Systems Command (AFSC) and the Air Force Logistics Command (AFLC) in supporting the Air Force operational commands. The chapter examines the roles of other major support commands in providing education and training, communications, personnel, accounting and finance, security, and other special services. After studying this chapter, you should be able to: (1) discuss the AFSC organization and its responsibility for weapon system development, (2) describe the AFLC logistics management responsibility and the relationship between AFSC and AFLC functions, and (3) describe the contributions of other support commands to the overall Air Force mission.

A MODERN military force must have technological and materiel support to maintain its operating capability. The US Air Force is no exception. It depends upon seven major support commands and nine separate operating agencies for supplies, weapon systems, maintenance, personnel, research and development, transportation, education and training, communications, and other special services. This chapter examines these support commands and agencies and their relationship to the combat posture of the Air Force.

## AIR FORCE SYSTEMS COMMAND (AFSC)

The United States has numerous resources available for use in improving its military technology—major industries, extensive transportation and communication systems, natural resources, and, above all, rich human resources. American scientists, technologists, industrialists, educators, and engineers are equal to any in the world in their creativity, technical knowledge, and skills. A variety of excellent research facilities are located throughout the country at universities, at technical institutes, in industry, in private, nonprofit organizations, and in the military services. The Air Force Systems Command is a research and development command established to marshal the nation's resources on behalf of the Air Force.

### The AFSC Mission

To understand the AFSC mission, one must understand the meaning of the word **systems** in the AFSC title. We considered several of these "systems" in preceding chapters. For example, a fighter aircraft, together with its weapons and electronic communications, navigation, and fire-control equipment, is an aircraft weapon system. A C–141 Starlifter, together with all its avionics, instruments, and cargo-handling equipment on board the plane and on the ground, is another kind of weapon system. There are also ground systems, such as SAGE. No one part of systems can be designed without consideration of the other parts. If different experts at different companies are engaged in developing a new aircraft system, their efforts must be coordinated. Even an administrative office can be a system. If a computer is used, it must be designed and developed as a part of a management system. Almost all modern, advanced equipment must be developed as part of a complex system. AFSC is the command charged with bringing new systems into the Air Force. It also is charged with conducting and managing its own and others' efforts in research, development, and procurement.

With headquarters at Andrews Air Force Base, Maryland, and installations and offices throughout the country and abroad, the

Air Force Systems Command provides the management and direction needed in conducting research and in producing, testing, engineering, and delivering weapon systems to the operational commands of the Air Force. AFSC also performs special missions assigned to it by the Department of Defense for other military services and for the National Aeronautics and Space Administration (NASA). The Air Force fulfills its assignments as a prime space agency and teams with NASA primarily through the Systems Command.

### AFSC Organization

Headquarters AFSC is responsible for the work of product and research divisions, test and development centers, and two national ranges. Three divisions are responsible for developing, testing, and procuring major systems and equipment, such as the F–15, B–1, AWACS, and Minuteman (Fig 42). The other divisions analyze and evaluate technological threats, conduct education and research programs, and support other organizations' procurement efforts. The centers provide facilities for testing and evaluating new systems. These facilities include rocket test stands, wind tunnels, simulators, and sled test tracks. The ranges provide a global

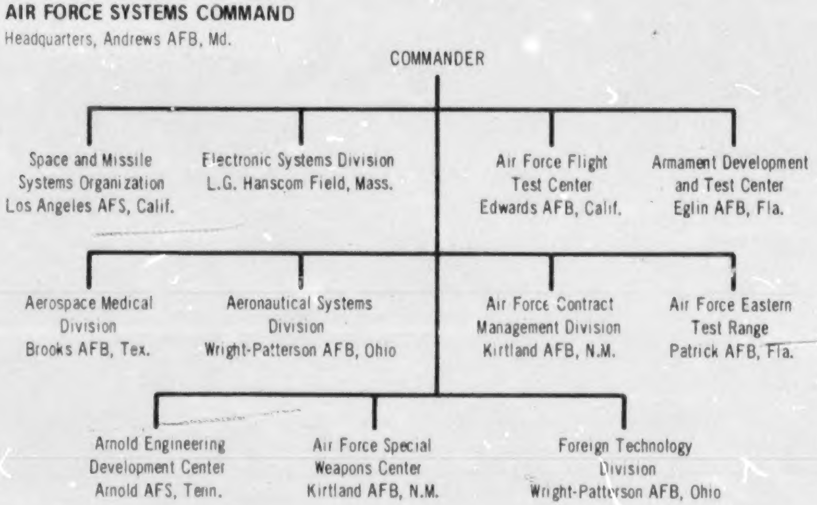

AIR FORCE SYSTEMS COMMAND
Headquarters, Andrews AFB, Md.
COMMANDER
Space and Missile Systems Organization Los Angeles AFS, Calif.
Electronic Systems Division L.G. Hanscom Field, Mass.
Air Force Flight Test Center Edwards AFB, Calif.
Armament Development and Test Center Eglin AFB, Fla.
Aerospace Medical Division Brooks AFB, Tex.
Aeronautical Systems Division Wright-Patterson AFB, Ohio
Air Force Contract Management Division Kirtland AFB, N.M.
Air Force Eastern Test Range Patrick AFB, Fla.
Arnold Engineering Development Center Arnold AFS, Tenn.
Air Force Special Weapons Center Kirtland AFB, N.M.
Foreign Technology Division Wright-Patterson AFB, Ohio

Figure 42. Organization of the Air Force Systems Command.

network for testing and tracking ballistic missiles, space launch vehicles, and various space systems.

AFSC DIVISIONS.—The AFSC divisions are the Space and Missile Systems Organization (SAMSO), Aeronautical Systems Division (ASD), Electronic Systems Division (ESD), Foreign Technology Division (FTD), Aerospace Medical Division (AMD), and the Air Force Contract Management Division (AFCMD).

The *Space and Missile System Organization*, Los Angeles, California, plans, develops, and acquires space and ballistic missile programs. It also manages the development of space boosters and other ground equipment used for launching and tracking DOD and NASA payloads.

SAMSO units perform in-orbit tests of DOD satellites, conduct ICBM research programs, and manage a number of satellite launches each year. One SAMSO unit, the Space and Missile Test Center, operates the Western Test Range, which extends halfway around the world from the California coast to the Indian Ocean. It maintains a vast network of data-gathering sites throughout the range to support its own test programs and those of the Strategic Air Command, the National Aeronautics and Space Administration, and other Government agencies.

The *Aeronautical Systems Division* at Wright-Patterson Air Force Base, Ohio, manages the development of aeronautical systems and related equipment. ASD assumes responsibility for the development of an aircraft from the drawing board to the final production. It modifies old aircraft and develops new ones, and it provides improved aircraft escape systems, new survival and recovery equipment, and other improvements based on the latest technological advances.

ASD has developed bombers, fighters, helicopters, vertical/short takeoff and landing aircraft (V/STOL), transports, trainers, reconnaissance aircraft, research aircraft, and nonballistic missiles. Examples of ASD developments are the F–111 variable-wing aircraft and the C–5 Galaxy. Currently under development are the B–1 advanced bomber, the F–15 air superiority fighter, and a variety of other vehicles.

The *Electronic Systems Division*, located at Laurence G. Hanscom Field near Boston, Massachusetts, is responsible for planning, procuring, testing, and installing global data processing and communications systems for the Air Force and other DOD agencies. It also develops techniques for operating this equipment, provides trained personnel, and furnishes supplies to keep the systems in operation.

ESD units collect information about aircraft movements, missile launchings, man-made objects in space, and electronic transmissions. ESD is the Air Force center for the application of computer technology to defense problems. Systems developed by ESD include, or will include, a global satellite detection and tracking network, the North American air defense system, communications networks in the Mediterranean, long-range radar and weather forecasting equipment, and an airborne radar and communications post (AWACS) for instant air defense and tactical air control anywhere in the world.

The *Foreign Technology Division*, located at Wright-Patterson Air Force Base, Ohio, provides reports on foreign science and technology to lessen the probability of technological surprise from other countries. Skilled FTD personnel and personnel from other divisions examine reports and equipment and evaluate them. Their final report provides useful information on the technological achievements of other nations and on possible weaknesses of potential enemies.

The *Aerospace Medical Division* is located at Brooks Air Force Base, Texas, and is the headquarters for a medical research, development, and educational organization. AMD manages research programs in clinical and aerospace medicine, and it conducts specialized education programs for medical technicians and postgraduate professional education courses in aerospace medicine. The division has also been involved in the selection and training of astronauts and in the research, development, and testing of life support systems that permit astronauts to function in the space environment.

The *Air Force Contract Management Division* is located at Kirtland AFB, New Mexico, and is responsible for managing DOD contracts. This division is composed of various management personnel, such as aeronautical and electronic engineers, comptrollers and accountants, economists, and quality assurance technicians. Their job is to assist the Government in holding the line on production costs, meeting time schedules, and achieving a high-quality product.

AIR FORCE TEST RANGES.—AFSC operates two test ranges: the Eastern Test Range and the Western Test Range. These ranges provide facilities for launching, tracking, and evaluating missile, satellite, and manned space systems. The Eastern Test Range maintains its launch site at Cape Kennedy and headquarters at Patrick Air Force Base, 15 miles to the south. From its launch site, it extends through the Atlantic Ocean to the Indian Ocean. This is the site from which the Mercury, Gemini, and Apollo astronauts were launched. Downrange tracking stations are located at Grand Bahama Island, Grand Turk, Antigua, and Ascension Island in the Atlantic Ocean. Ships and aircraft equipped with tracking instruments supplement the island tracking stations.

The Western Test Range, operated and maintained by the Space and Missile Test Center, has its launch sites at Vandenberg Air Force Base in southern California. This range extends through the Pacific Ocean into the Indian Ocean to 90 degrees east longitude where it meets the Eastern Test Range to form a single global tracking network. Tracking sites are located at Pillar Point in California; Kokee Park in Hawaii; and Eniwetok, Kwajalein, and Canton Islands in the Pacific Ocean. The Western Test Range specializes in launches of satellites into polar orbit and supports the operational training launches of the Strategic Air Command.

AFSC CENTERS.—The four AFSC centers provide highly specialized aerospace research and development and testing facilities. These centers are the Arnold Engineering Development Center (AEDC) at Arnold Air Force Station, Tennessee; Air Force Flight Test Center (AFFTC) at Edwards Air Force Base, California; Armament Development and Test Center (ADTC) at Eglin Air Force Base, Florida; and Air Force Special Weapons Center (AFSWC) at Kirtland Air Force Base, New Mexico.

The *Arnold Engineering Development Center* is located in the heart of the Tennessee Valley Authority's network of hydroelectric power stations. This is an ideal location for AEDC to secure electric power necessary to operate the free world's largest complex of wind tunnels, high altitude jet and rocket engine test cells, space environmental chambers, and hyperballistic ranges. Among the center's 38 test units are facilities for testing full-size or scale-model systems under environmental conditions similar to those at altitudes up to 1,000 miles and speeds up to 23 times the speed of sound. This complex is used extensively by the armed services, industry, Federal agencies, and educational and research institutions.

The *Air Force Flight Test Center* has a 15,000-foot man-made runway and natural runways up to 13 miles long formed by flat, dry lake beds. Because of extremely favorable climatic conditions in this section of the country, flight testing is possible for as many as 350 days per year. Here AFSC conducts experimental and acceptance tests of aircraft and aerospace vehicles. The center is also the home of the USAF Aerospace Research Pilot School, where pilots for future space flights are trained to master the space environment.

The Flight Test Center is famed for the achievement of the Air Force "X" series of research aircraft that have been tested at its facilities. The supersonic age of flight began at the center in 1947 when Air Force Capt Charles E. (Chuck) Yeager crossed the "sonic barrier" in the X–1 rocket plane. The X–15 manned research rocket plane, the forerunner of future aerospace craft, has flown faster and higher than any other manned aircraft to date. Gen Robert M. White, Commandant of AFROTC, received his astronaut wings for these flights and later commanded the Flight Test Center. During a speed run in May 1965, the YF–12A long-range interceptor broke nine official world records, seven previously held by the Soviet Union. AFFTC has tested aerospace vehicles ranging from the OV–10A to the giant C–5 and from high performance combat aircraft to the X–24 lifting body designed for future space flights.

Facilities at the *Armament Development and Test Center* include the Air Force Armament Laboratory, the Eglin Gulf Test Range over the Gulf of Mexico, eight other test ranges, and eight auxiliary airfields. These facilities are used for developing and testing conventional weapons and air-to-air/air-to-ground missile systems. Tests are conducted on a variety of equipment, including aircraft systems, guns, bombs, rockets, early warning radars, airborne electronic countermeasures, and related equipment. The equipment is not only tested under simulated combat conditions but also in extremes of weather produced by a Climatic Laboratory. ADTC works closely with the Special Operations Force of the Tactical Air Command and other operating commands in testing munitions and other equipment used in special warfare. The results of many of these tests have been incorporated into Air Force operations in Southeast Asia and elsewhere.

The *Air Force Special Weapons Center* conducts tests of nuclear and nonnuclear weapon systems for the Air Force, the Department of Defense, and the Atomic Energy Commission. The center maintains a fleet of test aircraft, conducts atmospheric nuclear tests, and provides air support for underground nuclear tests. It also provides facilities for testing the vulnerability of various types of equipment to nuclear shock. Included among the center's tests is a High Energy Simulation Technique test. This is a method of simulating a nuclear shock wave with nonnuclear devices. Thousands of feet of explosive cord are wrapped around wooden frames and placed in a test fixture that is buried underground. When the cord is detonated, the shock wave is measured to determine the effects of a nuclear weapon. At its installation on Holloman Air Force Base, Mexico, AFSWC operates a 35,000-foot high-speed rocket test track that simulates aircraft and missile flight environments. This track is used to test guidance systems, ejection seats, missile nose cones, and parachutes.

## AIR FORCE LOGISTICS COMMAND (AFLC)

**Logistics** is a reference to activities that support a military force by providing supplies, equipment, transportation, maintenance, construction, facilities, and evacuation of personnel. Logistics has also been described as that part of war that is not included in strategy and tactics. Logistics management is the responsibility of the Air Force Logistics Command. This major command controls items in the Air Force inventory ranging from transistors the size of pinheads to radar screens the size of football fields.

### The AFLC Mission

The mission of AFLC is to provide logistics support and services for Air Force organizations, systems, and other activities. The Logistics Command and the Air Force Systems Command have related responsibilities in this area. As we noted in the preceding section, AFSC conducts research and provides weapon systems to the operational commands of the Air Force. Thus, AFSC is responsible for systems development, and, as logistics manager, AFLC provides support in the development and use of such systems.

Basically, the Systems Command is responsible for the development of a new system from the drawing-board stage to the stage when the system has been tested and declared operational. That is, it is ready to be manufactured in quantity and delivered to the using commands. At this point, the system becomes the responsibility of the Logistics Command. AFLC must oversee the production, delivery to supply depots, storage, distribution, and maintenance of the system. As every home mechanic or automobile owner knows, effective maintenance depends upon the availability of parts. Therefore, in its responsibility for systems support, AFLC is responsible for the procurement of spare parts as well as their distribution. AFLC's responsibility for a system continues as long as the Air Force continues to use it. For example, if C–124 Globemasters built in the early 1950s are still being used in the Military Airlift Command Reserve units, AFLC's task is to see that spare parts for these aircraft are still being manufactured, warehoused, and distributed in the needed amounts.

The distinction between systems development and systems support is not a sharp one. There is no precise moment at which the Systems Command's responsibility for a system ends and that of the Logistics Command begins. It is, rather, a matter of varying degrees of responsibility at different times, somewhat as depicted in Figure 43. The Logistics Command works closely with the Systems Command during the developmental phases of a weapon system

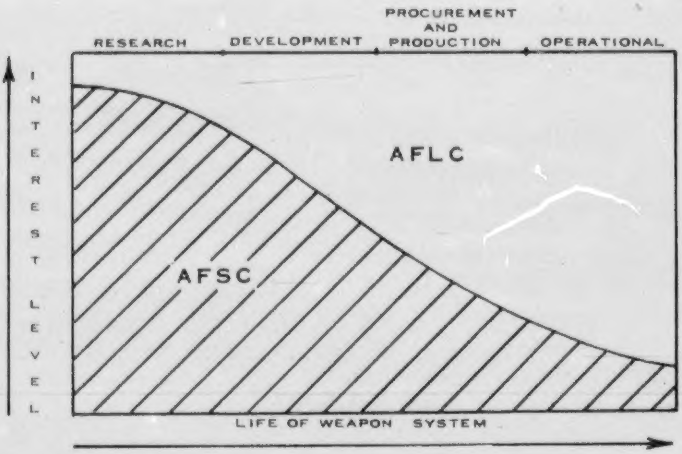


Figure 43. Life of a weapon system.

to insure that the new system can be supported logistically once it becomes operational. Therefore, AFLC's interest in the new system begins in the design stage. If the Logistics Command is to be responsible for procurement of spare parts, then it must consider the spare-parts problem quite early in the process. Or, if the item cannot be exposed to the weather in open storage, it will be up to the Logistics Command to provide the proper warehousing. The early prediction of a logistic-support problem or the discovery of a short cut will have an influence on a system design. Similarly, the interest of the Systems Command in an operational or even an obsolescent system continues. What improvements on a system are needed or possible? What requirements for an entirely new system are revealed by the shortcomings of the old?

AFLC is committed to the task of providing the logistics management necessary for combat air commands to keep their aircraft, missiles, and support equipment at top efficiency. It also must provide technical assistance and direction for base activities, such as the commissary, food service, laundry, and clothing sales. Although AFLC establishes operating policies for these services, it does not actually operate them.

AFLC operates through a system of air materiel areas and performs six major steps in the logistics function as follows:

1. Determine needs.
2. Procure needed items.
3. Maintain storage.
4. Distribute items to users.
5. Maintain and modify items.
6. Dispose of items no longer needed.

To function effectively, the Logistics Command pursues certain established goals. First, it must be sufficiently flexible to keep abreast of changing tactics and strategy, as well as improvements in weapon systems. Second, in cooperation with the Systems Command, it seeks to reduce the lapse of time between the production of a system and its availability to combat commands. Third, it seeks to develop improved management methods that aid in keeping pace with complex new weapons, reducing delays, and maintaining superior quality. Fourth, it promptly removes from the supply system obsolete and excess items caused by rapid advances in technology.

## AFLC Organization

Wright-Patterson Air Force Base, Ohio, is the headquarters of the Air Force Logistics Command. Compared to the overall size of the command, the headquarters organization is small, amounting to only one percent of AFLC's total personnel strength of slightly more than 100,000 people. This small headquarters organization is possible because AFLC follows the Air Force philosophy of maximum decentralization of operations. Headquarters establishes policies and monitors activities, but authority and responsibility for all operations are given to the lower levels.

In the past, the Air Force provided logistical support for its combat forces through an extensive network of depots located within the United States and in overseas areas. Because of improvements in transportation, computer technology, communications, and management techniques, however, such a far-flung logistics organization became unnecessary. Today, after closing its depots in the Pacific and in Europe, AFLC conducts its global logistics support activities from five **air materiel areas (AMAs),** all located within the United States (Fig 44). Each AMA is still responsible for logistics support within its geographical area, but, basically, each AMA has a global responsibility to support a specific weapon assigned to it. This means that the AMAs are the complexes that carry out most of AFLC's operational functions.

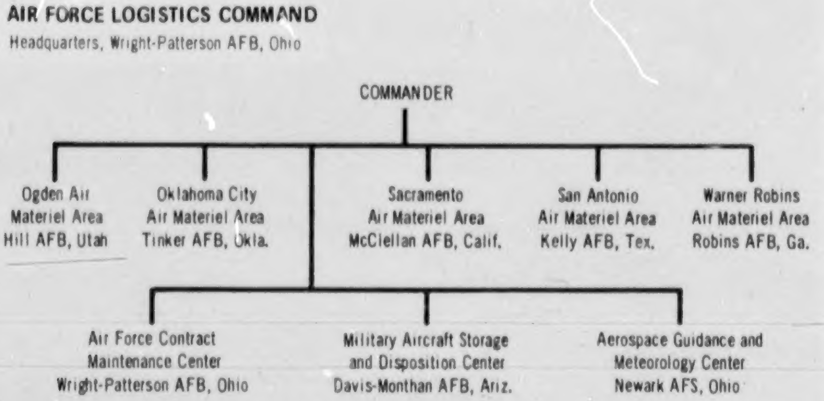

AIR FORCE LOGISTICS COMMAND
Headquarters, Wright-Patterson AFB, Ohio
COMMANDER
Ogden Air Materiel Area Hill AFB, Utah
Oklahoma City Air Materiel Area Tinker AFB, Okla.
Sacramento Air Materiel Area McClellan AFB, Calif.
San Antonio Air Materiel Area Kelly AFB, Tex.
Warner Robins Air Materiel Area Robins AFB, Ga.
Air Force Contract Maintenance Center Wright-Patterson AFB, Ohio
Military Aircraft Storage and Disposition Center Davis-Monthan AFB, Ariz.
Aerospace Guidance and Meteorology Center Newark AFS, Ohio

Figure 44. Organization of the Air Force Logistics Command.

When a request is made for a specific system or part of a system, a designated AMA is responsible for the distribution of the system or part to the requesting organization. This is accomplished in the shortest possible time, with maximum efficiency. For example, the San Antonio AMA provides support for the C–5 Galaxy. When a C–5 needs a replacement part, the organizational unit calls the San Antonio AMA and receives immediate service by air cargo delivery.

The locations and support assignments of AFLC's AMAs are as follows:

- Oklahoma City AMA, Tinker Air Force Base, Oklahoma. This unit provides worldwide logistics support for the B–5 strategic bomber and the KC–135 tanker, presidential aircraft, several jet engines (the J57, J75, TF30, and TF4), command and control systems, navigational aids, aircraft instruments, and hydraulic and environmental control systems.
- Ogden AMA, Hill Air Force Base, Utah, is responsible for the F–4 Phantom, F–101 Voodoo, Minuteman and Titan missiles, conventional air munitions, photographic equipment, and aircraft wheels, tires, brakes, and landing gear.
- San Antonio AMA, Kelly Air Force Base, Texas, supports the C–5, F–106, ~~other aircraft~~ systems, engines, life-support systems, nuclear weapon systems, and petroleum, oil, and lubricants (POL).
- Sacramento AMA, McClellan Air Force Base, California, supports the F–105, F–111, airborne detection systems, and air defense tracking systems.
- Warner Robins AMA, Robins Air Force Base, Georgia, handles logistics requirements for the F–15, the C–141, helicopters, tactical missiles (Falcon, Sparrow, and Sidewinder), airborne fire control systems, small arms, and communication systems.

The AMAs represent either the largest or second largest industrial employers in their respective geographical areas. AFLC manages almost nine billion dollars in assets and provides logistic assistance to 14,000 USAF aircraft, almost 6,000 aircraft of 60 other countries, approximately 40,000 jet engines, over 1,000 missiles, and a variety of radar and communication equipment. AFLC's workload depends upon Air Force operations at any given time and on the age and condition of weapon systems.

In addition to the AMAs, AFLC directs three specialized activities. The *Aerospace Guidance and Meteorology Center* at Newark, Ohio, is responsible for repairing and modifying inertial guidance systems used in DOD missiles and aircraft. The *Military Aircraft Storage Disposition Center* at Davis-Monthan Air Force Base, Arizona, is the single manager and storage site for all aircraft not currently operated by the Department of Defense (Fig 45). With all the old aircraft stored in the desert, the cen-

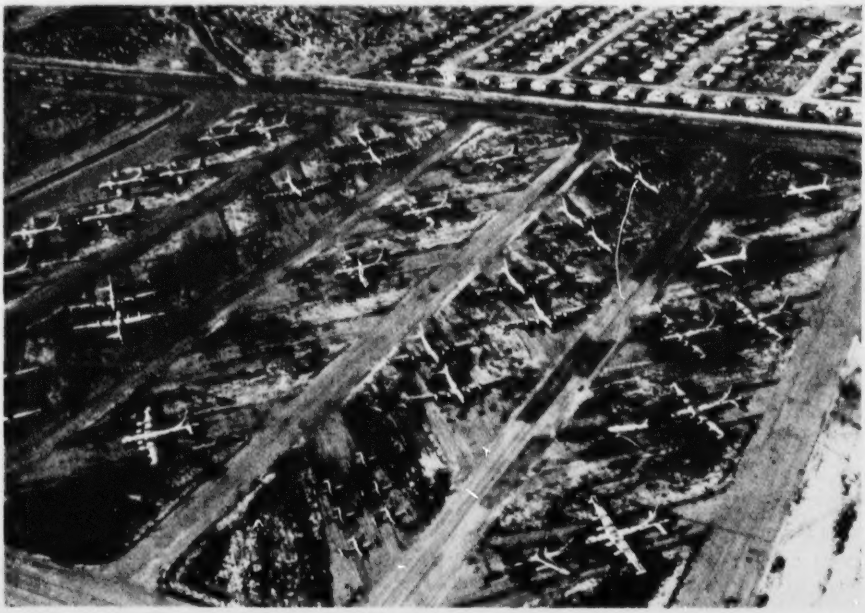


Figure 45. The "Boneyard" Davis-Monthan AFB, Arizona.

ter has become known as the "Boneyard." The *Air Force Contract Maintenance Center* at Wright-Patterson Air Force Base ~~directs and~~ controls contracts with private companies assigned by DOD to overhaul and repair USAF aircraft and other equipment.

## AIR UNIVERSITY (AU)

Maxwell Air Force Base, Alabama, is the location of the headquarters and most of the educational facilities of Air University. In pre-World War I days, Maxwell was the site used by Orville

Wright to experiment with his flying machines. In the 1930s, it was the location of the famed US Army Air Corps Tactical School, where many outstanding future Air Force leaders were trained and where much of the basic doctrine for the employment of air power was formulated. This school was the principal forerunner of the present Air University, which was established at Maxwell in 1946, more than a year before the Air Force became a separate service.

Today, Air University is a major command. Its mission includes supervision of various schools and related activities that comprise the Air University system. It conducts research associated with its mission and administers numerous programs and courses designed to provide commissioned and noncommissioned Air Force officers with professional skills. Air University prepares the students for additional responsibilities and more important assignments in command and staff positions throughout the Air Force.

The principal schools in the Air University system are the Squadron Officer School for first lieutenants and captains, the Air Command and Staff College for captains and majors, and the Air War College for lieutenant colonels and colonels. These three schools are the heart of the command's professional military education system for officers (Fig 46). At various times in their careers, selected officers can attend these schools as they advance in rank, experience, and responsibility. As of May 1972,

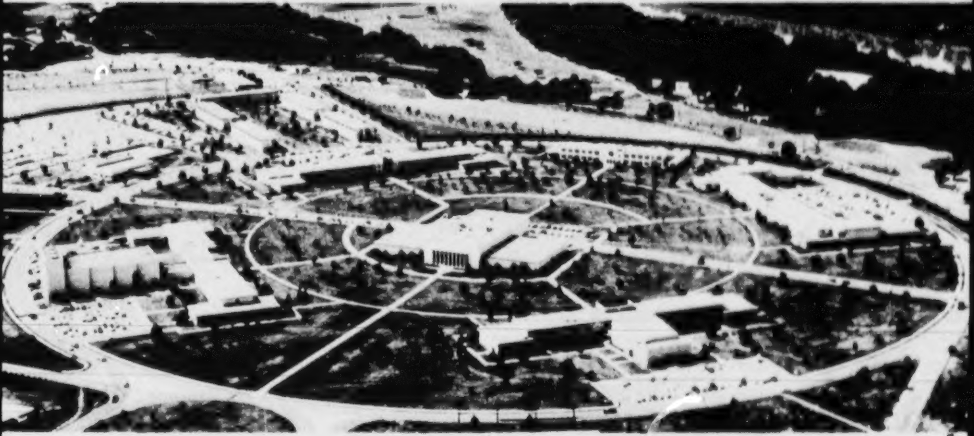


Figure 46. Air University academic circle.

more than 70,000 officers have received their professional education at Air University.

The Air Force Reserve Officers Training Corps (AFROTC) is a major component of Air University. From its headquarters at Maxwell Air Force Base, AFROTC administers programs in partnership with colleges, universities, and secondary schools throughout the United States. The senior AFROTC program is one of the primary sources of Air Force officers. Each year, approximately 4,000 graduates from 168 colleges and universities receive commissions as second lieutenants through the AFROTC program. The Junior AFROTC program is rapidly expanding from a pilot program that began in 1966 in 20 high schools across the nation. By the end of 1973, there will be 275 high schools with the Junior Air Force ROTC program in their curriculums. This program is designed primarily to inform high school students about the opportunities and challenges of aerospace. It also provides opportunities for students to develop qualities that will assist them in becoming effective future leaders.

A second major component of Air University, the Air Force Institute of Technology, is located at Wright-Patterson Air Force Base, Ohio. The institute places heavy emphasis on instruction in management and in the highly professional engineering fields. It offers degrees from the baccalaureate through the doctorate level. Confronted with the growing complexity of global logistics, expanding operations in space, and the demand for technically oriented specialists, the institute keeps pace by providing programs in these subjects. AFIT also administers a program for enrolling selected Air Force officers in civilian colleges and universities and in certain types of education with industry.

Air University also operates Extension Course Institute (ECI), the Air Force correspondence school and one of the largest correspondence schools in the world. Located at Gunter Air Force Base, Alabama, only a few miles from Maxwell, ECI's educational and training program reaches students at every Air Force base in the world and also thousands of Air Force Reserve, Air National Guard, and other qualified personnel. At any given time, 300,000 to 400,000 students may be enrolled in ECI courses. Although ECI is organizationally a part of the Air University system, its program of more than 200 different courses includes technical and career development studies provided by the Air Training Command as well as Air University.

Other Air University schools located at Maxwell include the AU Institute of Professional development (AUIPD), the Academic Instructor and Allied Officer School (AIAOS), the Air Force Chaplain School, and the Air Force Senior NCO Academy. AUIPD provides resident short courses in selected areas of professional education. For example, some of the specific educational requirements of the Air Force are currently being fulfilled by the personnel management, comptroller, computer sciences, and judge advocate courses. Other educational programs offered by the institute include a seminar for USAF commanders, an electronic warfare course for senior officers, and a weapons and space orientation courses for Allied officers. In one of its courses, AIAOS teaches its students how to be effective Air Force instructors; in another course, it instructs Allied officers in the English language, Air Force organization, and cultural patterns in the United States. The Air Force Chaplain School instructs newly-commissioned and senior chaplains in professional and military subjects related to their areas of responsibility. The most recent addition to the Air University system is the new Air Force Senior NCO Academy, which opened officially at Gunter Air Force Base, Alabama, in January 1973. This Academy is designed to prepare senior NCOs for higher supervisory and management responsibilities in the Air Force.

## AIR TRAINING COMMAND (ATC)

The Air Training Command (ATC) is the free world's largest training system. ATC existed in various forms during the early 1900s, but, with the outbreak of World War II, an increased need for trained personnel led to the establishment of ATC as a major air command. The Army Air Force Training Command was responsible for much of this wartime training; when the Air Force became a separate Service in 1947, the AAF Training

Command became the Air Training Command. The Korean conflict brought further changes in ATC. Prior to 1957, Scott Air Force Base, Illinois, had been the headquarters of ATC, but, during that year, it moved to its present site at Randolph Air Force Base, Texas. For more than 25 years, ATC has supplied the trained manpower to operate and maintain the nation's aerospace force.

Today, ATC operates 16 training bases within the United States and 91 field training detachments at various locations throughout the world. Since it became a major command in 1947, it has trained almost nine million men and women in courses ranging from human relations to advanced flying training. In FY72, it graduated more than 600,000 students from some 3,600 different courses in military, technical, and flying systems.

ATC has a fourfold mission: recruiting, military training, technical training, and flying training. To carry out its mission, it supervises a recruiting wing, which recruits approximately 93,000 enlistees each year; military, technical, and flying schools; special officer training schools; a marksmanship center; and mobile and field training detachments. In 1950, ATC assumed responsibility for training Allied students in the continental United States under the Air Force **Military Assistance Program (MAP).** Under this program, Allied students may enter the Undergraduate Pilot Training Program at one of ATC's undergraduate pilot training bases and become qualified as jet pilots. Or, if their country still uses reciprocating aircraft, they can take pilot training at Keesler Air Force Base, Mississippi, using the T-41 and T-28 aircraft.

All airmen and substantial numbers of officers receive basic and specialized training under ATC direction. Newly recruited airmen report to Lackland Military Training Center, Texas, for a six-weeks basic military training program. Here they are tested and counseled to determine their most suitable career fields. Upon completion of basic military training, most of them attend one of ATC's technical schools for specialized training in their career fields.

ATC provides precommission training for selected college graduates. The School of Military Science Officer **(SMS-O),** also at Lackland AFB, provides this training for college graduates who do not complete the ROTC program during their college years. Upon satisfactory completion of an intensive 12-week training program, they are commissioned as second lieutenants in the US

Air Force. Enlisted airmen may also pursue a program toward a commission. If they have at least one year of college, they may apply for the Airman Education and Commissioning Program. If they are accepted, they attend a university to complete their requirements for a college degree and then report to the School of Military Science, Officer, for precommission training. Another route to a commission through this school is the Bootstrap Commissioning Program. This program enables outstanding airmen and noncommissioned officers up to age 34 to receive commissions after they complete college degree requirements.

ATC conducts technical training at four technical training centers: Keesler Air Force Base, Mississippi; Sheppard Air Force Base, Texas; Lowry Air Force Base, Colorado; and Chanute Air Force Base, Illinois. The center at Keesler AFB conducts courses in electronics, communications, radio operations and repair, aircraft control and warning systems, and computer technology. Courses at Sheppard AFB include maintenance, missiles and space, civil engineering, comptroller, transportation, and communications. Also at Sheppard is the School of Health Care Sciences, which is responsible for the military orientation of all medical officers and nurses entering the Air Force. Lowry AFB

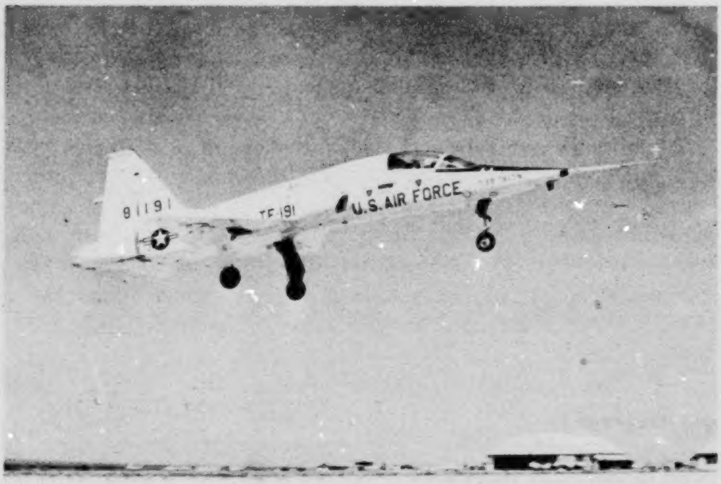


Figure 47. Pilot training in a supersonic, twin-engine T–38.

provides courses in intelligence, aerospace munitions, electronics, photography, and precision measuring equipment. Schools at Chanute AFB conduct courses in aerospace ground equipment, weather, motor vehicle maintenance, and flight training devices.

ATC's pilot training program consists mainly of the undergraduate pilot training (UPT) course which enables a flying cadet to earn his pilot wings. This program is conducted in the southern half of the United States. The UPT program consists of three phases totaling 48 weeks of intensive instruction. During this period, the student receives 208 hours of flying instruction and 462 hours of instruction in academic and officer training subjects (Fig 47).

## AIR FORCE COMMUNICATIONS SERVICE (AFCS)

The Air Force Communications Service, with headquarters at Richards-Gebaur Air Force Base, Missouri, is a major command that operates global communications, air traffic control, and air navigation systems for the Air Force and other Government agencies. It is known as a "conduit for command" because its mission is to provide rapid and efficient communications that make it possible for other major commands, organizations, and agencies to do their jobs. In other words, it provides individual commands with a global communications capability and with fixed and mobile flight facilities.

AFCS operates throughout the world as a tenant command; that is, it has no bases of its own. All AFCS personnel are assigned to bases operated by other commands. This command has units on every Air Force base in the world and maintains some remote installations of its own. As a supporting command, AFCS provides on-base communications at all bases except ADC and SAC bases, which have their own command-and-control systems.

Additionally, it provides on-base intercommunications systems, fire and crash alarms, air police and security alerting systems, and closed-circuit television. It also provides long-distance communications that link Air Force installations around the globe.

Computers, of course, have drastically changed all Air Force operations, but AFCS use of automation has been phenomenal. Three major automated systems carry virtually all of the command's communications: Automatic Digital Network **(AUTODIN),** Automatic Voice Network **(AUTOVON),** and Automatic Secure Voice Communications Network **(AUTOSEVOCOM)** AUTOVON is a leased telephone system that carries voice communications within the continental United States. This system provides the Department of Defense with a global communications service that links more than a million telephones, teletypes, and high-speed data equipment. AUTODIN is the largest and most advanced digital communications system in the world. With this system, AFCS has a global capability to handle over 40 million punched cards or the equivalent of almost 600 million words each day. AUTOSEVOCOM is a system of automatic and manual switches, security devices, and other equipment that permits secure voice communication for all classified information. Commanders can use this system at any time to exercise immediate command and control of their forces.

Automation has also brought improvements in air traffic control systems. One such improvement is a Flight Data Entry and Printout system that permits air traffic controllers to handle flight-plan information automatically instead of manually. The latest advance in air traffic control is the development of a system known as AN/TPN–19 Landing Control Central. This system is designed for use with mobile tactical units and on permanent bases. Upon completion of initial testing, it is scheduled to replace the present ground-controlled approach system and also provide a backup to the Instrument Landing System. Other improvements in these systems not only permit air traffic controllers to handle additional duties but also improve flight safety.

In addition to these functions, AFCS provides air navigation aids, such as radio ranges, direction finders, homing beacons, and tactical navigation aids. At more than 600 locations around the world, AFCS can provide immediate and accurate communication to handle any kind of emergency.

## US AIR FORCE SECURITY SERVICE (USAFSS)

Another major command is the United States Air Force Security Service, with headquarters at Kelly Air Force Base, Texas. USAFSS monitors all Air Force communications to insure compliance with established communications security practices and procedures. USAFSS units occasionally conduct research in communications phenomena in support of various elements of the US Government. Other functions of this command include the storage, distribution, accounting, and maintenance of coded materials.

## HEADQUARTERS COMMAND, USAF

Headquarters Command has the most varied support mission in the Air Force. This command, headquartered at Bolling Air Force Base, Washington, DC, supports Headquarters USAF and other Air Force units located in the Washington, DC area. Air Force personnel assigned to the command include those directly assigned to various unified commands (PACOM, USREDCOM, ALCOM) or Government agencies, such as NORAD, NATO, Federal Aviation Administration, Defense Supply Agency, various Military Assistance and Advisory Groups detailed to foreign nations, and the National Aeronautics and Space Administration. Headquarters

Command is the administrative home command of all Air Force astronauts. Operational and support units under Headquarters Command include Malcolm Grow USAF Medical Center at Andrews AFB, USAF Band at Bolling AFB, Headquarters Civil Air Patrol-USAF at Maxwell AFB, Alabama, and the USAF Honor Guard. The command also has operational control of the USAF Postal and Carrier Service.

## SEPARATE OPERATING AGENCIES

A **separate operating agency** is an organization directly subordinate to Headquarters USAF but outside the normal organizational structure of the Air Force. Such an organization performs specialized support functions in a given operational area. Presently, nine separate operating agencies conduct specialized activities in education and training, AF Reserve direction and control, financial support, automatic data systems, AF personnel management, special investigations, auditing, and safety inspections.

### Air Force Academy (USAFA)

The United States Air Force Academy, established in 1954, is the newest of the three military academies. It is located at Colorado Springs, Colorado, on an 18,000-acre site in the foothills of the Rocky Mountains. Here young men prepare themselves for careers as Air Force officers through a four-year undergraduate study program that leads to a baccalaureate degree in science (Fig 48).

As a major source of newly commissioned officers, the Academy provides instruction, experience, and motivation that enables a cadet to graduate with the knowledge, character, and leadership qualities necessary for an Air Force career. The Academy curriculum is so designed that it provides a foundation for further development in any of the numerous career fields available to Air Force officers. It is neither an engineering nor liberal curriculum but is balanced between basic applied sciences and the humanities and the arts. Cadets who satisfactorily complete the prescribed course of study graduate with BS degrees and commissions as second lieutenants in the Regular Air Force.

In addition to their academic studies, cadets receive instruction in military skills, leadership, and flying. Military skills are learned in the classroom and through field experience gained in

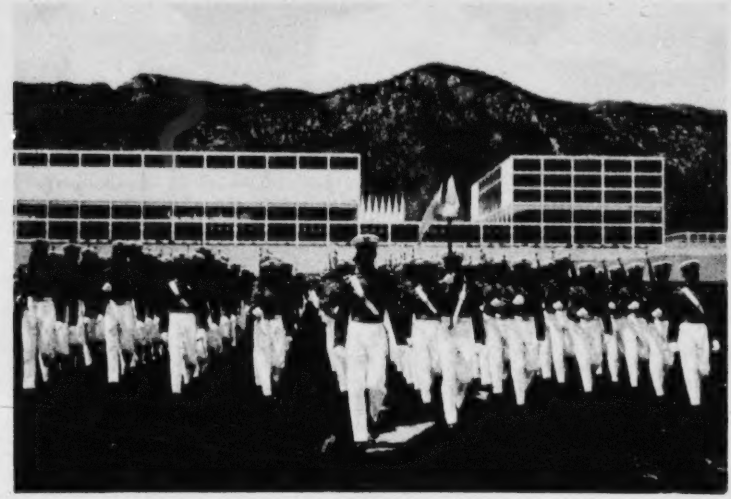


Figure 48. Air Force Academy cadets on the march.

summer military training programs. These programs consist of leadership training, basic cadet training, airmanship, Air Force research projects, and survival training. Flying training on the T-41 aircraft is provided under a pilot indoctrination program for qualified seniors who plan to enter pilot training after graduation. The training is conducted by the ATC 3253d Pilot Training Squadron and Academy personnel at nearby Peterson Field. This program permits cadets to complete the equivalent of Phase I of ATC undergraduate pilot training before they leave the Academy.

### Headquarters Air Force Reserve (AFRES)

Headquarters Air Force Reserve, Robins Air Force Base, Georgia, is directly responsible to the Chief of Staff, USAF, with technical direction and control provided by the Office of Air Force Reserve. The AFRES mission is to direct and train the nation's thousands of Air Force Reservists for active duty in the event of an emergency. The agency provides field commander supervision over Air Force Reserve units and individual Reservists. These Reservists are assigned to augment units under the agency's supervision in the event of mobilization.

AFRES is divided into three regions, which are, in turn, divided into flying units and nonflying units. The flying units include airlift wings, aerospace rescue and recovery squadrons, an airborne early warning and control squadron, and aeromedical evacuation squadrons. Reserve units fly a variety of aircraft, such as the C-130, HC-130, C123K, F105, A-37, EC-121, C-7A, and HH-34. Some associate airlift groups fly the C-141, C-9, and the C-5, the aircraft used by their active duty partners in the Military Airlift Command. Nonflying units include aerial post squadrons, military airlift support squadrons (mobile enroute), maintenance squadrons (mobile), supply squadrons (mobile support), medical service units, air postal units, and censorship units. Flying units have performed a wide variety of missions ranging from mercy missions to airlifting cargo to US troops in Vietnam.

Air Force Reserve training programs are constantly updated. This assures that the Reserve units will be prepared for immediate action in the command to which they will be assigned in the event of war. Constant training, dedication, and professionalism are the mainstays of the "Ready Now" Air Force Reserve.

### Air Reserve Personnel Center (ARPC)

Also under the direction and supervision of the Office of Air Force Reserve is the Air Reserve Personnel Center (ARPC) at Denver, Colorado. The Center administers management and personnel programs for Air Force Reserve personnel who are not on extended active duty. In addition, the Center provides administrative capability to mobilize Air Force Reservists in the event of a national emergency. It also maintains personnel data and provides reports pertaining to Air Force Reservists.

ACCOUNTING AND FINANCE CENTER
UNITED STATES AIR FORCE

### Air Force Accounting and Finance (AFAFC)

The Air Force Accounting and Finance Center located at Denver, Colorado, is a separate operating agency that performs centralized accounting and finance functions for the Air Force. It provides technical supervision, advice, and guidance to a global force of Air Force accounting and finance offices. Its centralized activities include issuing allotment checks to dependents, banks, or insurance agencies and retirement checks to Air Force retirees. Other activities include issuing savings bonds, processing thousands of monthly reports, maintaining military pay records, and preparing and reporting fiscal data needed by USAF fund and program managers.

### Air Force Data Automation Agency (AFDAA)

Gunter Air Force Base, Alabama, is the headquarters of the Air Force Data Automation Agency. This separate operating agency performs consolidated data automation activities in support of Headquarters USAF, major commands, bases, Office of the Secretary of Defense, and other Federal agencies. These activities include automatic data processing, computer and management science services, and planning and developing computerized management information. AFDAA also has certain responsibilities for the design, development, and maintenance of automated data systems. Other activites include technical support and guidance throughout the Federal Government for analysis of automatic data processing systems. AFDAA operates from three centers as follows:

Air Force Data Services Center, Washington, DC

Federal ADP Simulation Center, Washington, DC

Air Force Data Systems Design Center, Gunter AFB, Alabama

### Air Force Military Personnel Center (AFMPC)

The Air Force Military Personnel Center at Randolph Air Force Base, Texas, manages and administers personnel plans, programs, policies, and guidance for all Air Force military personnel. It analyzes current and future personnel requirements to insure a proper balance of skilled personnel and workloads. AFMPC directs and supervises programs related to promotions, retirements, separations, absenteeism and desertion, assignments, and career development. It maintains an automated record system for all Air Force military personnel.

### Air Force Office of Special Investigation (AFOSI)

Washington, DC, is the headquarters of the Air Force Office of Special Investigations, but it maintains district offices, detachments, and operating locations throughout the United States and in various overseas areas. It provides global services in counterintelligence, criminal, and special investigations for all Air Force activities. Counterintelligence investigations conducted by AFOSI include instances of espionage, sabotage, treason, sedition, subversion, and major security violations involving Air Force personnel and property. AFOSI investigates major criminal offenses committed against Air Force personnel, their property, or the Air Force. In general, criminal investigations are limited to offenses committed on Air Force property by persons subject to the Uniform Code of Military Justice. Minor offenses are handled by security police. Civilian offenses, such as illegal possession of Air Force property are the investigative responsibility of the Federal Bureau of Investigation. Special investigations conducted by AFOSI include personnel background investigations in support of the DOD security-clearance program.

### Air Force Audit Agency (AFAA)

Headquarters of the Air Force Audit Agency is located at Norton Air Force Base, California. This is an internal audit organization that evaluates the effectiveness and efficiency of managerial functions in Air Force financial, operational, and support activities. The commander of the AFAA has the title of Auditor General and Assistant Comptroller of the Air Force. He reports directly to the Comptroller of the Air Force, but he also has direct contact with the Assistant Air Force Secretary for Financial Management. His global force of approximately 1,200 people examines policies, systems, and procedures concerning the Air Force's use of its resources—men, money, and material.

### Air Force Inspection and Safety Center (AFISC)

Also located at Norton Air Force Base, California, is the Air Force Inspection and Safety Center. This separate operating agency directs and monitors the Air Force inspection system and safety programs. It conducts investigations and inspections of all

Air Force activities to determine the state of training, combat capability, and logistic support. It evaluates the ability of individuals, units, and equipment to perform their missions effectively, safely, and economically. AFISC also conducts accident investigations in the areas of flight, missile, space, and nuclear safety.

## WORDS, PHRASES, AND NAMES TO REMEMBER

air materiel area (AMA)
AUTODIN
AUTOSEVOCOM
AUTOVON
logistics
Military Assistance Program (MAP)
School of Military Science, Officer (SMS-O)
separate operating agency
systems

## REVIEW QUESTIONS

**1. What is the meaning of the word "systems" in Air Force Systems Command?**

**2. Compare the functions of AFSC and AFLC in the life cycle of a system.**

**3. What is an air materiel area, and what are some of its responsibilities?**

**4. What is the parent command of the Air Force Junior ROTC? What other functions are performed by this major command in support of the Air Force mission?**

**5. How does the mission of the Air Training Command differ from that of Air University?**

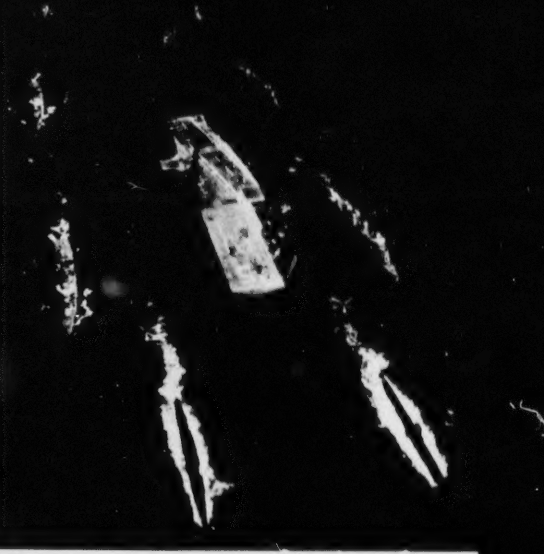
**6. What three major automated systems carry virtually all of the communications actiivties of the Air Force Communications Service?**

**7. What is the function of separate operating agencies, and how do they differ from major commands?**

## THINGS TO DO

1. On a map of the United States, locate and write in the names of all bases maintained by major support commands and separate operating agencies of the Air Force. Use symbols to distinguish one command or agency from the other. On a separate key, list the symbol, the name of the base or separate operating agency, and the mission of each.

# *Chapter* 5



# Army, Navy, and Marine Corps Aerospace Forces

**THIS CHAPTER discusses the aerospace components of the Army, Navy, and Marine Corps and describes the roles of these components in the field organization and operations of these Services. The chapter describes the aircraft and weapons used by the Army and the Navy and explains why these Services require specially designed weapon systems to accomplish their mission. After studying this chapter, you should be able to: (1) explain how Army and Navy aviation components contribute to the operational requirements of these Services, (2) identify and describe the aircraft and weapons used by the Army and Navy, and (3) discuss the role of Marine aviation as it relates to the organization and mission of the Marine Corps.**

THE TOTAL MILITARY aerospace power of the United States is not wielded by the Air Force alone. Important segments of military aviation and missile firepower are contributed by the Army, Navy, and Marine Corps. The effectiveness of any one military Service in combat depends upon close teamwork with other Services. This teamwork can extend downward to joint task force organizations on a small scale and, especially, to the coordination of aviation efforts.

In this chapter, our purpose is to examine the role of the Army, Navy, and Marine Corps in military aerospace. We also consider certain missiles employed by the Army and Navy to the extent that they compare with certain Air Force weapons and constitute a part of the nation's total aerospace capability.

## UNITED STATES ARMY

The basic role of the Army, as the nation's land force, is to defeat enemy forces in land combat and to control land and people during and after the conflict. Its primary mission is to conduct prompt and sustained combat on land wherever and whenever it is called upon. Therefore, it must be prepared for a wide range of operations. It may be involved in countering tensions or in outright combat. Its operations may vary from counterinsurgency actions against guerrillas to full-scale organized infantry assaults. Its forces are capable of employing nuclear or nonnuclear weapons. In terms of the three main missions of US Armed Forces—strategic offensive, strategic defensive, and general purpose—the Army is involved primarily in the strategic defensive and general purpose missions. As we have seen earlier, the Army's strategic defensive forces are integrated with the forces of the other Services under NORAD. The major part of its forces are general purpose forces integrated with the general purpose forces of other Services in theater commands and the US Readiness Command.

### Army-Air Force Coordination

Air superiority is a prerequisite for large-scale land operations. For this reason, the Army maintains air offensive and defensive forces to augment and support ground operations. Over the years, it has developed and maintained thousands of aircraft, trained thousands of aircrews, and developed doctrine and tactics for the employment of air power. Today, Army aerospace forces are designed to complement rather than rival those of the Air Force. The role of Army aerospace forces is limited to that of supporting the following land-combat operations: command, control, and communications; intelligence; airmobility; combat service support; and firepower. In addition, the Army maintains air defense artillery elements designed to destroy, nullify, or reduce the effectiveness of enemy aircraft and missiles against US ground forces.

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In Army employment, the ability of aircraft to land in and take off from small clearings, rough terrain, and short or improved landing strips has long been regarded as paramount. Therefore, Army emphasis has been on rotary-wing aircraft (helicopters), supplemented by fixed-wing aircraft that are small and light or have short takeoff and landing (STOL) capability. Nevertheless, some functions of Army aviation have overlapped the functions of certain tactical Air Force elements, especially in such operations as short-range tactical airlift, reconnaissance, and close combat support. Both Services formerly used helicopters and fixed-wing aircraft in similar missions, and both are interested in research and development of vertical/short takeoff and landing (V/STOL) aircraft.

However, an agreement among the Joint Chiefs of Staff in 1966 reaffirmed Army emphasis on helicopters and Air Force emphasis on fixed-wing aircraft. On the basis of this agreement, the Air Force, in general, limits its use of helicopters to search-and-rescue missions. The Army, in turn, relinquished its operation of two STOL transport aircraft, the C–7 Caribou and the C–8 Buffalo, to the Air Force but retained a smaller fixed-wing utility aircraft called the U–1A Otter. The Army now limits its use of fixed-wing aircraft to light planes of the utility and observation types for reconnaissance, fire adjustment, command, and administrative uses. For numerous similar and other logistic and combat tasks, it uses large and small helicopters. Both the Army and the Air Force, together with the Navy, continue joint sponsorship of research and development of V/STOL aircraft.

A ground commander decides, on the basis of his knowledge and experience, the types of aircraft and the Service to be employed for a given mission. For example, he may need to determine whether a certain enemy position should be attacked by an Army "aerial artillery" helicopter armed with machine guns and "Mighty Mouse" rockets, by the heavier firepower of an Air Force jet fighter, or by the sustained firepower of ground artillery. If he selects ground artillery, then he must decide whether the guns, crews, and ammunition must be brought into position by overland transportation, by Army Chinook helicopters, or by an Air Force transport plane. Since the commander has the backup of an efficient joint Army-Air Force (and sometimes Navy) communications network, he can make his decision on the basis of what he knows about the situation and what he knows about Army, Air Force, and Navy aviation resources that are available in the area.

At the same time, however, he must also possess an even broader knowledge of the capabilities and limitations of various Army, Navy, and Air Force aviation resources and those most suited to a particular task. Interservice teamwork developed by joint training and maneuvers gives the ground commander a wider range of choices in the accomplishment of a given mission.

Another example of interservice teamwork is the evacuation of a wounded soldier from the spot where he falls in battle to a hospital in the United States. The trip might begin under fire in an Army helicopter, continue in an Air Force C-123, and then, for the transoceanic flight, a jet C-135 or C-141 of the Military Airlift Command.

### Army Aviation Organization

To understand the Army's use of aviation, one must understand something about the Army's field organization. In the field, the various Army arms and services—such as armor, artillery, signal, and aviation—lose their separate identities and higher command structures and become part of combined forces. For example, armed helicopters used to attack ground targets are called **"aerial artillery"** and are placed under the same command with ground artillery. All these elements can usually be found in one division, the main unit of combined arms and services. Divisions can be grouped in larger organizations called corps or still larger forces of several corps called field armies. Certain types of units such as aviation and artillery can either belong to divisions or be pooled at corps level for flexible employment over a large battlefront where several divisions are fighting.

There are five specific types of divisions: infantry, mechanized infantry, armored, airborne, and airmobile. This does not mean that an entire division consists of one type of combat element, only that these elements are balanced differently. Both an armored division and an infantry division, for example, have both tank and infantry units, but the proportions vary. So do the kinds and amounts of artillery, aviation, and other components.

An infantry division has approximately 100 aircraft, mostly helicopters. Some of these aircraft are assigned to an air cavalry troop to assist this element in providing reconnaissance and security for the division. Others are used by the division artillery units to provide command and control and aerial fire adjustment. A few aircraft are assigned to each brigade headquarters for command and control purposes. Almost half of an infantry division's aircraft belong to an aviation battalion, which provides general aviation support to these other elements and also includes an airmobile company for the airlifting and supply of infantry assault elements. To keep these aircraft in proper condition, the division has its own aircraft maintenance company, which also has a capability to repair avionics equipment.

The aviation of most other divisions is about the same in quantity, if different in makeup. An exception is the **airmobile division.** It deserves special mention because it is the division that makes maximum use of Army aviation. An airmobile division is equipped with no less than 425 helicopters, plus a half-dozen or so fixed-wing observation aircraft. More than half of this aviation is organized in an aviation group, with three battalions; the rest is broken into smaller units to serve as air cavalry and to support artillery, headquarters, and support units. With more than four times as many aircraft as other divisions, the airmobile division is capable of lifting itself into action and is better adapted for fighting in jungle, mountain, or other wild terrain than the more heavily-equipped divisions (although it lacks the firepower of the latter.) An airmobile division has about half as many ground vehicles as an infantry division, and has no tanks. Its artillery is light, consisting of battalions of towed 105 mm howitzers, plus a battalion of armed "Huey" helicopters serving as aerial artillery, and a company equipped with lighter helicopters for observation and fire adjustment. In short, everything about an airmobile division—vehicles, weapons, equipment, organization, and training—is built around helicopter airmobility.

The airmobile division should not be confused with the *airborne* division. For the sake of deployment by means of such tactical Air Force airlift planes as the C–130 Hercules, the airborne division is also streamlined and specially trained and equipped. It has more than the average complement of airborne infantry or paratroopers, but it has no more than the normal amount of divisional Army aviation.

A new dimension in the Army's combat capability is the **TRICAP** division. This division consists of an air cavalry brigade, an airmobile infantry brigade, and an armored brigade. Its combat mission is to conduct sustained, highly mobile operations to destroy enemy forces and control land areas. It can conduct combined arms operations and mobile defense operations using combinations of air cavalry, airmobile, and armored forces. The division's aviation battalion has one assault support helicopter company for logistical support and three troop carrying assault helicopter companies. An air defense battalion can be attacked if necessary. The TRICAP division has a total strength of approximately 13,000 men.

### Army Aircraft and Their Employment

Army aircraft represent a series of compromises between conflicting characteristics. The mission of Army aviation requires equipment that is rugged, easy to maintain, simple to operate, and highly maneuverable. In keeping with these requirements, an aircraft's STOL capability is a primary consideration. Army aircraft are frequently employed at the small-unit level for extended periods. Therefore, simplicity of design is important not only to reduce manufacturing costs but also to reduce the cost of operation and maintenance.

The flight characteristics of Army helicopters enable them to operate from landing areas that are unsuited for fixed-wing aircraft. This capability permits better concealment in forward ground combat areas. Although a slow-flying helicopter may seem to be more of a "sitting duck" than a fixed-wing jet aircraft, the helicopter's ability to take evasive maneuvers, hover near the ground, escape radar or visual detection by hiding behind hills or treetops and appearing in unexpected places gives it an advantage that is envied in some instances by the crews of fixed-wing aircraft. The most serious shortcomings of helicopters are their limited range and more extensive maintenance requirements than fixed-wing aircraft. However, the gas turbine engine and a system of complete inert replacement have all but eliminated these shortcomings.

As mentioned earlier, Army aviation provides support within each of five land-combat functions: (1) command, control, and communications; (2) intelligence; (3) airmobility; (4) combat service; and (5) firepower.

A combat unit commander can use Army aircraft to exercise command and control over his forces. Aircraft provide him with a rapid and efficient means of acquiring information and communicating with his subordinate units. He can use aircraft to visit and inspect units under his command and to assure himself that operations are conducted according to his policies. During operations, he can use a helicopter as an aerial command post to observe developments and issue commands.

Army aviation increases the effectiveness of the intelligence effort by providing for the rapid collection of information. Aircraft can be used in aerial surveillance, reconnaissance, and observation. The Army's primary surveillance aircraft is the OV–1 Mohawk, a twin turboprop two-seat aircraft that combines a speed of 300 miles per hour with endurance and STOL capability to gather information rapidly (Fig 49). Different versions of the OV–1 may employ visual, infrared, radar, or photographic techniques to detect enemy equipment, movement, and strength. The OV–1 can be defensively armed, but it is not designed to provide aerial artillery firepower. The Army uses both fixed- and rotary-wing aircraft to conduct reconnaissance missions, including armed reconnaissance to obtain information about specific targets.

The airmobility function involves the transport of troops, equipment, and supplies *within* the Army combat zone. This includes the movement of units to execute airlanded operations, movement of reserves, shifting and relocating units and individuals, and movement of units for rear area security and damage control. The principal aircraft used in this role are the UH–1 Iroquois (Fig 50) and the CH–47 Chinook helicopters (Fig 51). The payloads of these helicopters range from one to twelve tons, depending on their mission. This capability enables the Army to shift forces rapidly and to take advantage of the terrain and the immediate tactical situation. Also in the Army aircraft inventory for use in this role is the smaller fixed-wing U–1A Otter. Aircraft, of course,

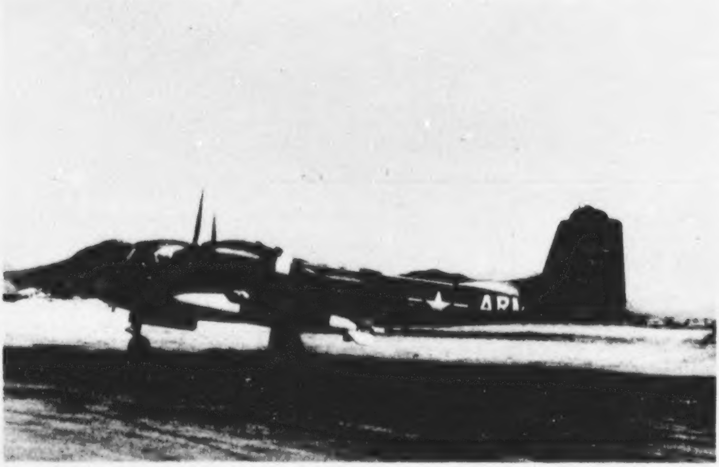

**Figure 49. A US Army OV–1 Mohawk reconnaissance aircraft at Hue Phu Bai, South Vietnam.**

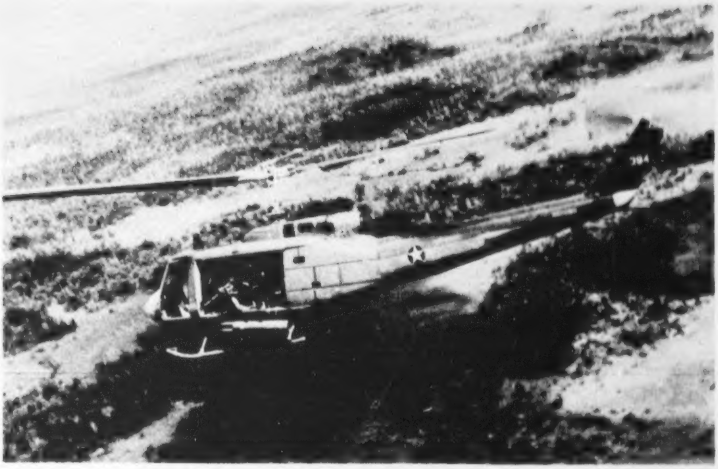

Figure 50. UH–1H helicopter in action over Vietnam.

Figure 51. The CH–47 Chinook cargo helicopter.

do not eliminate the need for ground transportation, but they are being used increasingly in both offensive and defensive actions.

Army aviation also provides combat service support for various logistical operations. This support includes aerial movement of troops and equipment, aeromedical evacuation of casualties, and evacuation of damaged equipment within a combat zone. Although all utility aircraft may be used in this role, the CH–47 Chinook and the CH–54 Flying Crane are the primary cargo helicopters (Fig 52). The CH–54 can lift a 10-ton payload either in the form of a detachable van or sling load, but it lacks the range and speed of the more versatile CH–47.

Aircraft contribute significantly to the Army's firepower. Direct aerial fire support enhances a ground commander's capability to deliver fire on the enemy. The purpose of such support is not to replace close air support provided by the Air Force or the Navy. The Army has mounted light automatic weapons and rockets on most rotary-wing aircraft to provide direct fire support for operations that employ Army aviation and ground troops. These

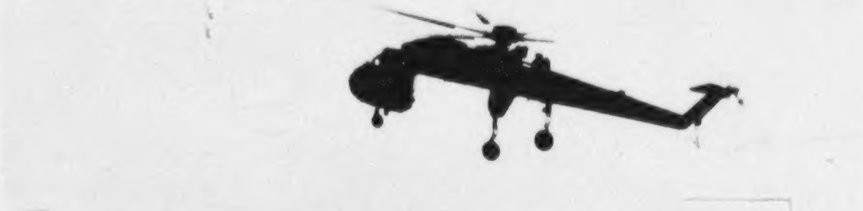

Figure 52. A US Army CH–54 helicopter airlifting a 9,000 lb pole from Phu Cat Air Base to Pleiku Air Base, South Vietnam.

aircraft can not only be used for armed aerial reconnaissance but also for armed aerial escort to protect airmobile forces by suppressing enemy ground-to-air fire. The UH–1 Iroquois utility helicopter and the AH–1G (Huey Cobra) attack helicopter, particularly, are fitted with a variety of weapon systems. An advanced aerial fire support system (AAFSS) is under development. This system will be a low subsonic, vertical rising, stable vehicle with a weapons system designed to provide fire against the enemy as an extension of the fire delivered by friendly weapons on the ground.

Other Army aircraft used in the combat support role are the O–1 Bird Dog observation aircraft; the U–6A Beaver, U–8D Seminole, and the U–21 Ute utility aircraft; and the OH–6A Cayuse and OH–58 Kiowa light observation helicopters.

Although the helicopter appears to be more vulnerable to enemy fire than a fixed-wing aircraft, its ability to maneuver, hover, and fly at low altitudes gives it several advantages over fixed-wing aircraft, particularly in jungle areas such as those in Southeast Asia.

The Army's interest in future aircraft development is mainly in retaining these talents while overcoming lack of speed and range. This could mean either an improved helicopter or a V/STOL fixed-wing aircraft. Experimental helicopters have reached speeds over 250 mph by means of a propeller or jet engine independent of the rotor drive (compound helicopter) or a jet-tipped rotor. Meanwhile, various jet or turboprop V/STOL aircraft have made experimental flights under tri-service auspices.

### Army Air Defense Artillery (ADA)

The mission of Army air defense artillery units is to destroy, nullify, or reduce the effectiveness of an enemy air or missile attack. To accomplish this mission, ADA units are responsible for supporting Army ground forces in the conduct of land warfare, providing forces for the air defense of the United States and US assets overseas, and monitoring the Safeguard ballistic defense system. These units are equipped with guided missiles, a gun system, and fire distribution systems. They are capable of placing immediate and effective fire on fast moving aerial targets. Their function is to destroy a target, destroy a weapon carried by an air vehicle, force a target to release its bombload early, or force a target to change its course.

Weapons used by ADA units are classified according to their major roles. There is no single, all-purpose ADA weapon. The

Army depends upon a carefully integrated family of complementary weapon systems. Each system is designed for a specific role on the basis of its altitude and range capabilities. Current ADA weapon systems include the Nike-Hercules, the Hawk, the Redeye, the Chaparral, and the Vulcan.

The **Nike-Hercules** is a semimobile, long-range system designed to defend against the medium- and high-altitude air threat. It has successfully engaged targets traveling at speeds in excess of 2,100 miles per hour at ranges over 75 miles, and it has proven its effectiveness against targets at altitudes above 100,000 feet. The Nike-Hercules is a two-stage, supersonic missile that may be armed with either a nuclear or high-explosive warhead (Fig 53).

Some Nike-Hercules systems have been modified for use against smaller, faster, higher flying targets in the future electronic countermeasures environment. The Army calls this modification the **Improved Nike-Hercules.** Improvements include an increased target detection capability and tactical controls. In addition to their primary surface-to-air mission, both the Nike-Hercules and the improved system may be used in a surface-to-surface role as a secondary mission.

The **Hawk** is a highly mobile weapon system designed for low- and medium-altitude targets. It is capable of defending against aircraft that attempt to escape radar detection and attack at low altitudes. Although it is designed primarily to meet the low-altitude threat, it also provides excellent defense against

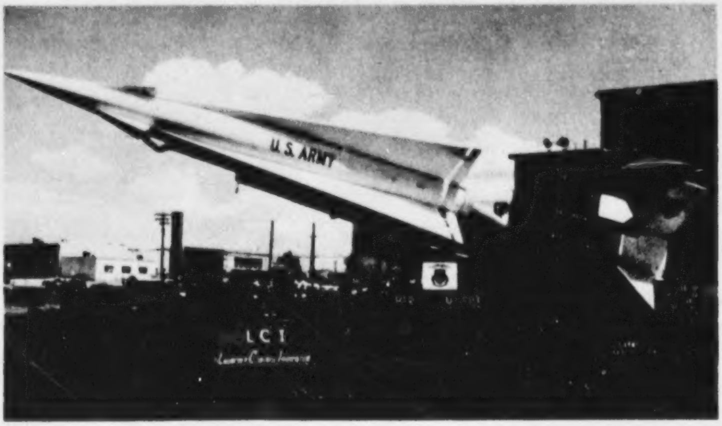

Figure 53. US Army Nike-Hercules interceptor missile.

medium-altitude targets. The Hawk is an all-weather missile capable of a range over 20 miles and an altitude in excess of 38,000 feet. It is equipped with a solid-propellant motor and armed with a high-explosive warhead. Towed or self-propelled, the Hawk can fire simultaneously at two or three different targets (Fig 54).

The Redeye is a surface-to-air, low-altitude air defense missile designed for use in a forward battle area. This weapon can be carried by a man and fired from the shoulder. An average of 50

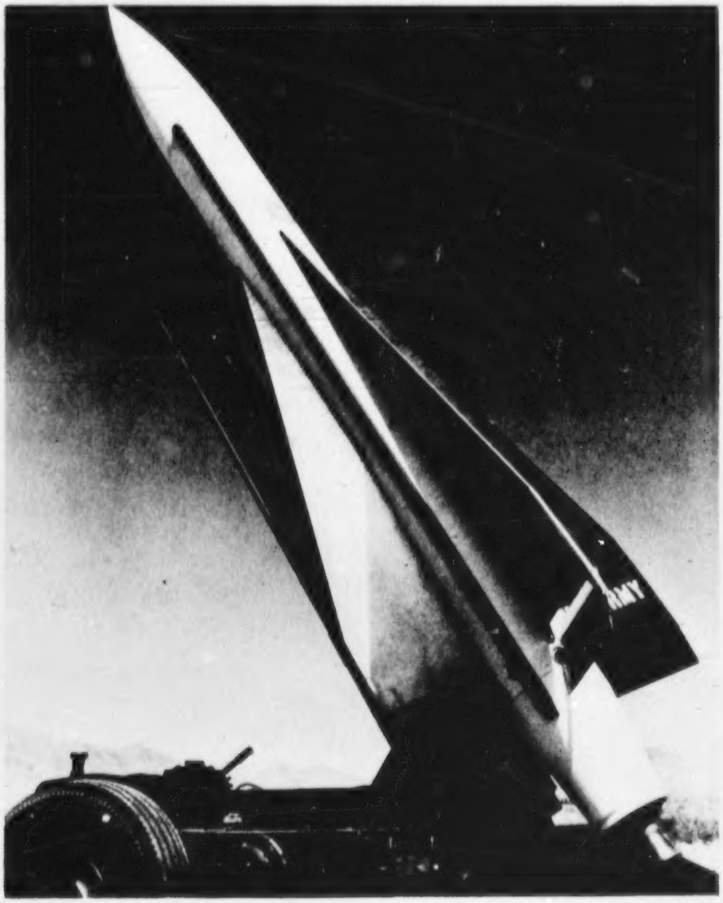

Figure 54. A US Army Hawk missile.

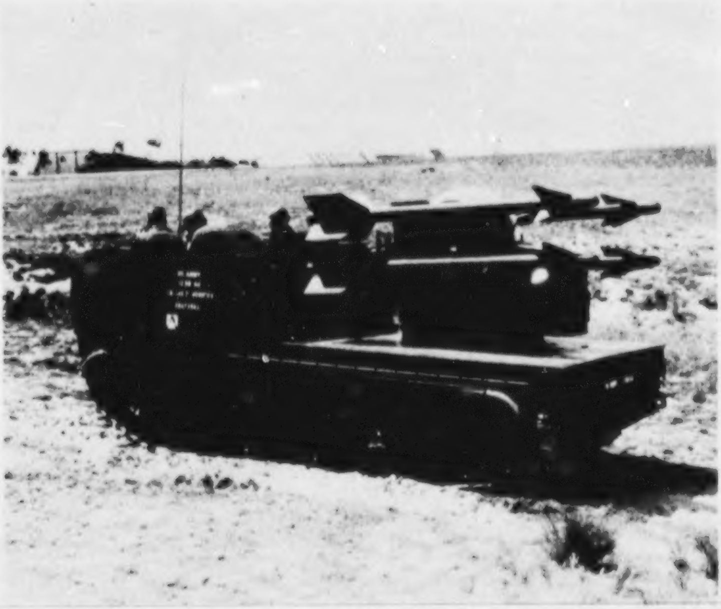

Figure 55. US Army Chaparral missile system.

two-man Redeye teams operate in Army divisions. They are deployed in companysize units, and they can engage a wide variety of targets, including propeller-driven and jet aircraft, as well as helicopters. The missile is sealed in the launcher and cannot be removed in the field except by firing. It has an infrared, homing guidance system, a solid-propellant motor, and a high-explosive warhead.

The **Chaparral** is a highly mobile, visually directed guided missile system. This system includes a full-tracked vehicle on which is mounted a launcher with four Chaparral missiles. The Chaparral is a surface-to-air, infrared-homing missile that is used to provide low-altitude air defense in a forward combat area. An infrared seeker in the head of the missile tracks the heat source of a target, such as an aircraft engine. The Chaparral system operates as a part of an ADA Chaparral/Vulcan battalion, and it may be used to complement Hawk and Nike-Hercules low-altitude coverage in area defenses (Fig 55).

The **Vulcan** is the Army's newest fair-weather, visually directed automatic weapon system. It consists of a turret-mounted M61A1 "Gatling" 20mm gun, an ammunition storage and feed system, a gyro lead-computing sight, and a ranging radar. The turret is mounted on a full-tracked, armored personnel carrier. The Vulcan is capable of delivering effective fire at a very high rate on high-speed, low-flying aerial targets. It is also effective against moving or stationary ground targets. Used with the Chaparral, the Vulcan enhances the Army's ability to defend a forward combat area against both ground and air attack. The gun uses standard 20mm armor-piercing incendiary, high-explosive incendiary, and ball ammunition.

Future ADA weapon systems include **Safeguard** and Surface-to-Air Missile Development (SAM-D). The Safeguard missile system, consisting of Spartan and Sprint missiles, will be deployed for defense against intercontinental ballistic missiles. As mentioned in an earlier chapter, the first Safeguard system will be operational by the mid-1970s. The Safeguard system includes radars, a computer system, power generation and environmental equipment, and two interceptor missiles, the Spartan and the Sprint.

The SAM-D will be an air defense system for use in both battlefield and continental air defense against high-performance aircraft. It can be deployed as a battery to defend a complete sector, or a fire section consisting of a fire control group and several launchers may be detached for independent operation. The fire control group contains a radar, a weapon control computer, communications, and prime power. Its multifunction radar system will detect targets, track them, and track and issue guidance commands to the missile in flight. The launchers will carry several single-stage, solid-propellant missiles. This system will be capable of firing missiles either in single shots or in close-sequence salvos.

## UNITED STATES NAVY

US naval forces include all forces and reserve components of the Navy, the Marine Corps, and, when it operates as part of the Navy, the Coast Guard. The Navy's overall objective is to be prepared for all military missions as directed by the President and the Secretary of Defense. More specifically, in time of war, the Navy's primary mission is to seek out and destroy enemy forces at sea, destroy or suppress enemy sea commerce, maintain control of the sea, and conduct land and air operations as necessary to accomplish these ends.

Because of its striking power, versatility, and mobility, naval aviation is indispensable in controlling the seas against all threats, including submarines and land-based aircraft. It has a vital role in defending US shores against invasion and supporting the movement of US and Allied forces to areas where they are needed. In the event of a nuclear war, the Navy's highly mobile aircraft acrriers and nuclear-capable aircraft could provide the margin necessary for national survival. Since these forces cannot be pinpointed in advance for destruction, they provide an important element of US retaliatory capability in the event of a surprise attack. In limited war, naval aviation has the built-in mobility, flexibility, and speed to move quickly and decisively to almost any scene of conflict.

Operations conducted by naval aviation forces include early warning and countermeasures, antisubmarine, minelaying and minesweeping, naval reconnaissance, and aerial photography. If land-based air support is not available, naval air forces conduct tactical air operations and provide close air support during amphibious or aerial seizure of enemy territory.

Nuclear-propelled submarines armed with Polaris or Poseidon missiles constitute an important part of the Navy's offensive forces. The relative security of the nuclear-powered submarine and the submarine-launched ballistic missile gives them a unique capability. Navy components on a smaller scale function as elements of the NORAD defensive system. The Navy's main forces, like those of the Army, can be classed as general purpose forces.

### The Aircraft Carrier

As a self-supporting, at-sea air base, the aircraft carrier is a major offensive instrument of naval sea power. One of the most significant characteristics of an aircraft carrier is its ability to concentrate air power or to deploy readily to a scene of conflict. Another characteristic is the carrier's strategic mobility. Since 70 percent of the earth's surface is water, aircraft launched from aircraft carriers can influence almost 90 percent of the world's inhabited areas. Carrier striking forces provide vital support to operations conducted by other naval forces or by the land-based forces of other Services. If land air bases are not available, carriers can launch aircraft to cover and support amphibious landings or withdrawals (Fig 56).

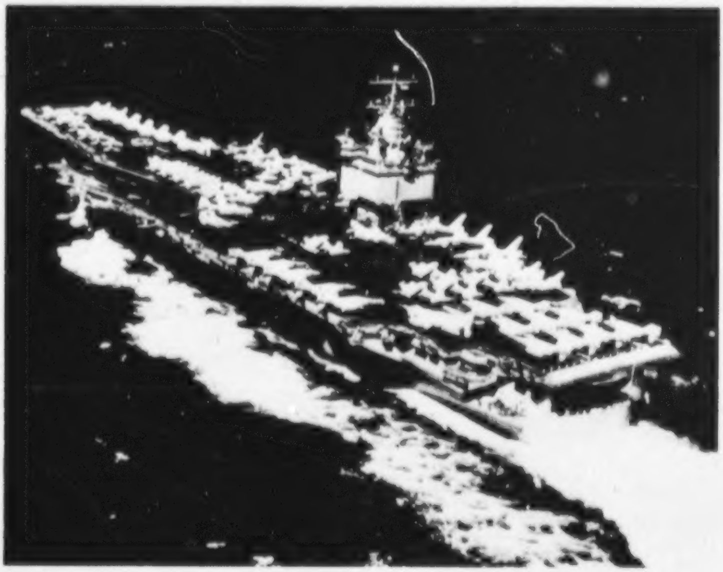

Figure 56. Nuclear powered aircraft carrier USS Enterprise.

Because of its flexibility, an aircraft carrier provides two advantages to striking forces: (1) air strikes can be made more rapidly and frequently over a shorter range, and (2) air strikes can be made from unpredictable directions. In providing these advantages, the carrier eliminates the need for building new airfields. The carrier, of course, offers a vulnerable target to any enemy ship, submarine, or aircraft that can penetrate its defenses, but it has formidable defenses to protect it from such attacks. These defenses include powerful weapons and detection devices on board the carrier and on board destroyers and other escorts that accompany the carrier.

An attack carrier organization includes a variety of ships and aircraft. The basic unit is the attack carrier striking group, which consists of one or more attack carriers supported by missile cruisers and protected by destroyers. Formerly, individual carrier striking groups have included as many as five carriers. However, with the increased capability of modern weapons and aircraft, the present trend is toward less carriers in each group. This permits greater flexibility in operations without reducing offensive or defensive capability. Depending upon the requirements of a given operation, antisubmarine carrier groups or individual antisubmarine carriers may be assigned to the striking force.

An attack carrier air wing consists basically of fighter and attack squadrons. However, a heavy attack squadron may include airborne early warning, aerial photographic, or electronic countermeasures reconnaissance squadrons. The air antisubmarine warfare (ASW) organization consists of ASW support aircraft carriers, ASW carrier air groups, and patrol squadrons. ASW support aircraft carriers with embarked aircraft normally form a submarine hunter-killer group. ASW carrier air groups include both fixed- and rotary-wing antisubmarine squadrons.

### Naval Aircraft

Naval aviation functions as an operating element of the fleet in the same sense as the submarine, destroyer, cruiser, or an amphibious force. Its primary mission is to maintain control of the air in support of fleet operations; it does not function as an autonomous or separate fighting force. Although the naval air arm is limited primarily to aircraft carrier operations, the Navy employs a wide variety of aircraft for advanced intelligence operations, photo reconnaissance, early warning, fighter protection, search and destruction of submarines, and destruction of enemy forces. Included in the Navy inventory are attack, fighter, utility, observation, patrol, transport, antisubmarine, airborne early warning, and trainer aircraft. The Navy also maintains a large fleet of helicopters.

Since the Navy's primary mission is to control the seas against all threats, the core of the naval air arm is the aircraft carrier with carrier-based aircraft. This means that most of the aircraft used by the Navy must be specially designed to meet the unique requirements of carrier operations. For example, because of space limitations, carrier-based aircraft must be equipped with folding wings to conserve parking space. Not only is parking space limited on board the aircraft carrier; landing and takeoff areas are also restricted. Therefore, carrier-based aircraft must be capable of short takeoffs and landings. And, to meet the shock of catapulted launchings and arrested landings, they require reinforced landing gear and fuselages. Like that of the Air Force, the Navy's air arm includes a full array of subsonic and supersonic aircraft ranging from heavy fixed-wing transports to small helicopters. This text includes only a few representative types of naval aircraft to illustrate the Navy's role in US military aerospace operations.

Two outstanding Navy attack planes are the A-4 Skyhawk and the A-6 Intruder. The A-4 Skyhawk, designed in the early 1950s as a replacement for the propeller-driven Skyraider, has been the workhorse of the Navy's attack squadrons. The A-4 is a lightweight attack and support aircraft capable of delivering conventional or nuclear weapons. It is equipped with 20mm guns, rockets, and missiles, and it can carry a variety of bombs. The A-6 Intruder is an attack bomber capable of detecting and identifying targets and delivering conventional and nuclear explosive, including Sidewinder and Bullpup missiles and a variety of bombs and rockets, in any kind of weather, day or night. It is an extremely accurate, low-altitude, long-range, subsonic weapon system with an 18,000-pound payload, a speed of almost 600 miles per hour, and a combat radius of 1,100 nautical miles (Fig 57).

One of the most recent additions to the Navy inventory of fighter aircraft is the swept-wing F-14 Tomcat, designed as the Navy's primary fleet fighter (Fig 58). The Tomcat has a maximum speed in excess of mach 2 and a combat capability at altitudes over 50,000 feet, and it can land or take off in a space less than 3,000 feet. With its AWG-9 weapon control system, it can launch and fire up to six Phoenix missiles at six separate targets and keep the missiles on course simultaneously. It can carry bombs, rockets, 20mm Vulcan cannon, and Sidewinder, Spar-

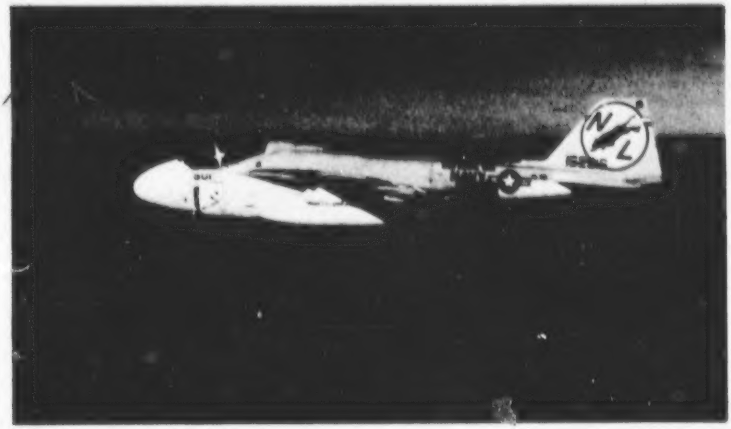

Figure 57. US Navy A-6A Intruder attack aircraft.

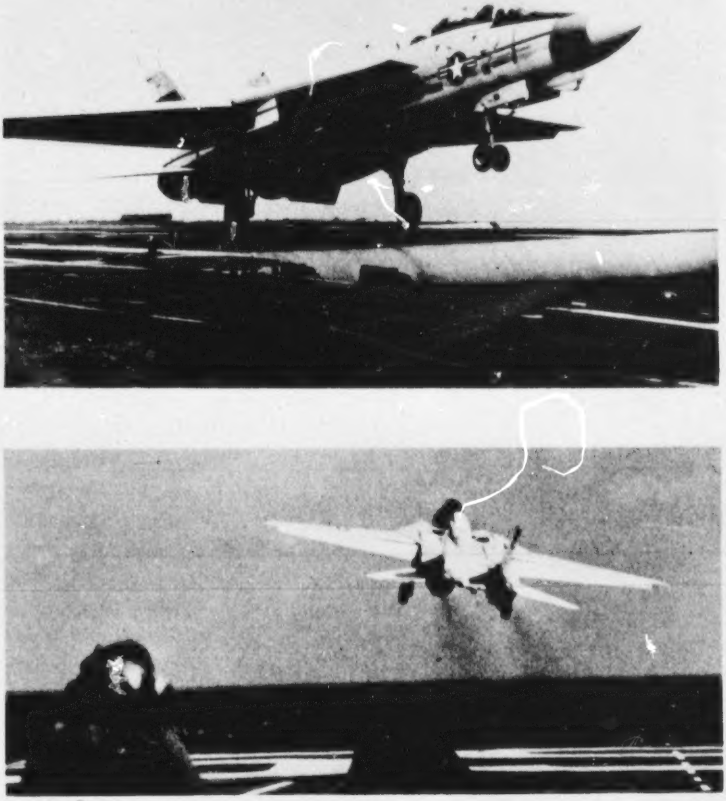

**Figure 58. Two views of the F–14A Tomcat fighter being launched from flight deck of USS Forrestal.**

row, and Phoenix missiles. This aircraft is capable of performing three primary missions: (1) fighter escort to protect the Navy's strike force, (2) defense of carrier task forces, and (3) attacks on ground targets. One of the mainstays of the Navy's fighter force has been the F–4 Phantom II. This aircraft was a workhorse in Vietnam and has held 15 world speed, altitude, and time-to-climb records. It can carry Sparrow missiles and approximately eight tons of bombs, mines, and rockets simultaneously.

The E–2A Hawkeye is the Navy's airborne early warning command and control aircraft (Fig 59). The Hawkeye's primary mission is to patrol the approaches to the fleet and to detect an impending attack by enemy aircraft, missiles, or sea forces. In addition to this function, it provides strike and traffic control, search and rescue guidance, and communications relay service. With its sophisticated electronics equipment and all-weather capability, the Hawkeye is a vital part of the Navy's defensive and offensive forces. Its five-man crew—two pilots and three equipment operators—can direct interceptors and strike aircraft to their assigned targets in fair or foul weather and, at the same time, provide a long-range early warning screen for naval task forces. Advanced radar and computer systems on the E–2B and 2C models enable the Hawkeye to surround the fleet with an early warning ring capable of directing air defenses against any enemy.

Two other naval aircraft of particular interest are the P–3 Orion and the S–3A Viking (Fig 60). These are specially equipped aircraft used in antisubmarine warfare (ASW) operations. The P–3 Orion is a long-range, land-based ASW patrol aircraft with an operational speed ranging from 150 to 380 knots and an operational ceiling over 30,000 feet. For its ASW mission, it carries sophisticated electronic detection gear, including sonobuoys, radar, electronic countermeasures equipment, and various navigation devices. Its armament includes torpedoes, depth charges, bombs, and rockets, which may be carried in the bomb bay or on underwing pylons. The latest version of the Orion, the P–3C, has an airborne general purpose digital computer and new ASW sensors.

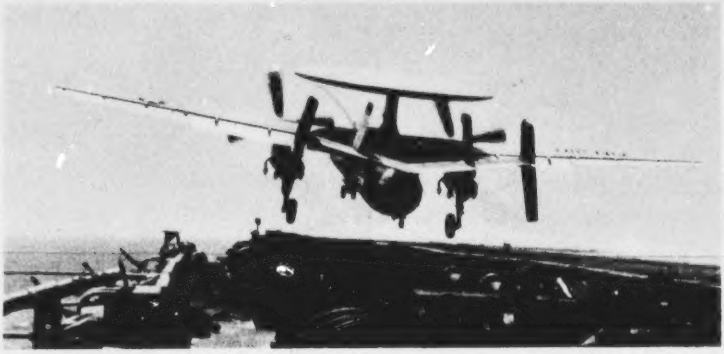

Figure 59. A US Navy E–2B Hawkeye airborne early warning aircraft.

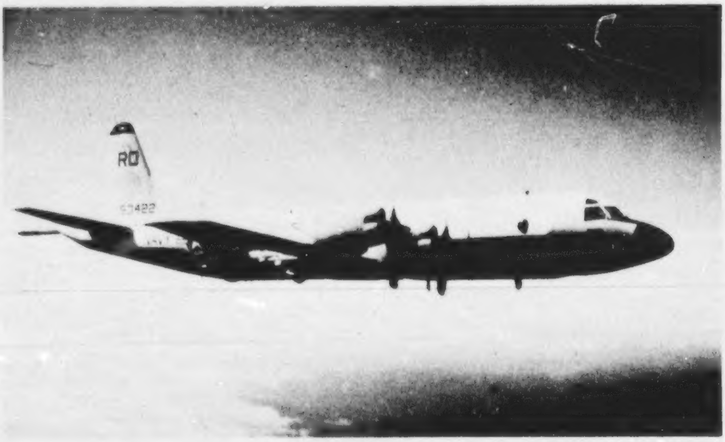

Figure 60. A P–3 Orion submarine hunter.

The computer integrates all information necessary for the crew to detect, localize, and destroy an enemy submarine. The P–3C also carries a low-light level television system that permits visual observation of surface objects previously undetected by the human eye.

The S–3A Viking is a carrier-based, long-range, all-weather ASW aircraft scheduled to replace the Navy's S–2 Tracker series sometime in 1974. Unlike the land-based Orion, the Viking has folding wings and a large vertical tail that folds sideways to conserve carrier space. It is designed to operate at altitudes above 35,000 feet at speeds in excess of 300 knots during search operations. From sea level, it can climb at the rate of more than 4,200 feet per minute. By comparison, the S–2 Tracker operates under 10,000 feet at 135 knots during search operations. The key to the Viking's effectiveness as an ASW weapon system is its highly sophisticated avionics system. This system enables it to locate and destroy enemy submarines and provide surface surveillance over a combat range of more than 2,000 nautical miles. Together, the S–3A and the P–3 Orion constitute a potent challenge to the submarine threat.

As mentioned earlier, these are only representative types from a vast array of fixed- and rotary-wing aircraft used by the Navy in accomplishing its mission. Many of the Navy's helicopters and utility, observation, and transport aircraft are the same as those employed by the Air Force and the Army: the U-1 Otter, O-1 Bird Dog, C-47 Skytrain, C-130 Hercules, H-1 Iroquois, and Hueycobra. Others are specially designed to meet Navy requirements.

### Ballistic Missile Submarines

Nuclear propulsion and the capability to launch submerged intermediate-range ballistic missiles have greatly enhanced the submarine's potential in modern war. Historically, the submarine's primary mission has been to deny use of the sea to the enemy. This is still the submarine's primary mission. However, a new dimension has been added with the development of submarines capable of launching missiles deep into enemy territory.

In independent patrols, nuclear-powered submarines can operate effectively for indefinite periods, even in waters under enemy control. In many areas, submarines and aircraft operating together provide a formidable combination of naval strength against enemy surface ships and submarines. Aircraft provide long-range reconnaissance capability, which submarines often lack; submarines, on the other hand, provide the capability for lethal surprise attacks.

In addition to its conventional role, the nuclear-powered submarine's capability to launch intermediate-range ballistic missiles is a significant factor in the development of offensive and defensive weapon systems. Concealed and mobile missile-launching submarines offer obvious military advantages both to a defender and to an attacker. They are not susceptible to destruction in a surprise or preemptive attack, and they operate at sea and outside the homeland. The ballistic missile submarine makes a vital contribution to the nation that depends on a powerful and secure retaliatory force to defend itself against a nuclear attack.

The Navy's contribution to the Triad, mentioned earlier, is the fleet ballistic missile (FBM) submarine force. This force consists of 41 nuclear-powered submarines capable of remaining submerged for months at a time. With almost unlimited cruising range and endurance limited only by its crew, an FBM nuclear submarine can conduct submerged operations over approximately 70 percent of the earth's surface. The submarine can launch its Polaris missile within minutes after receiving the command; it does not require a long countdown. Each FBM submarine carries 16 Polaris missiles stowed in eight pairs of vertical launching tubes. These missiles have ranges from 1,500 to 2,500 miles, enabling them to penetrate to the heart of any continent from concealed underseas locations anywhere in the world.

The FBM force is not organized under a single command but is divided between the Atlantic and Pacific fleets. Like the forces of the Strategic Air Command, however, the FBM force is directly responsive to the Joint Chiefs of Staff and the President. FBM submarines operate in the Atlantic under the control of the Commander in Chief, US Atlantic Command, and, in the Pacific, under the control of the Commander in Chief, US Pacific Command. Assignments and the selection of targets are made under the control of the Joint Chiefs of Staff (JCS). The JCS also control assignments of FBM submarines to other parts of the nation's retaliatory force.

The FBM system is based on the Polaris missile, supplemented by the Poseidon. The Polaris A–3 is a two-stage ballistic missile powered by solid-fuel rocket motors and inertially guided by a system that operates independently of external commands and controls. It is launched deep underwater; an air or gas/team system propels it to the surface, and the rocket motors ignite as the missile emerges into the air (Fig 61). The Poseidon C–3 is quite different from the Polaris A–3. The Polaris is 4.5 feet in diameter and 31 feet long; the Poseidon is 6 feet in diameter and 34 feet long. The Poseidon is fitted with multiple independently targeted reentry vehicles **(MIRV).** It has a greater payload capability and accuracy than the Polaris A–3.

As an eventual replacement for the present FBM force, the Navy is considering a long-range missile system for launch from submerged submarines. The underseas long-range missile system (ULMS) will result in an approximate tenfold increase in the sea area from which ULMS submarines can reach their targets. This will provide added insurance against a possible breakthrough in antisubmarine warfare capabilities by a potential enemy. The ULMS will also place missile submarines within target range at all times, even when they are in port.

### Antiair Warfare

Navy antiair warfare operations are directed against aircraft and missiles, as well as their supporting forces and operating bases. Antiair warfare (AAW) is conducted in support of the overall force mission, and it includes active and passive measures to achieve and maintain air superiority.

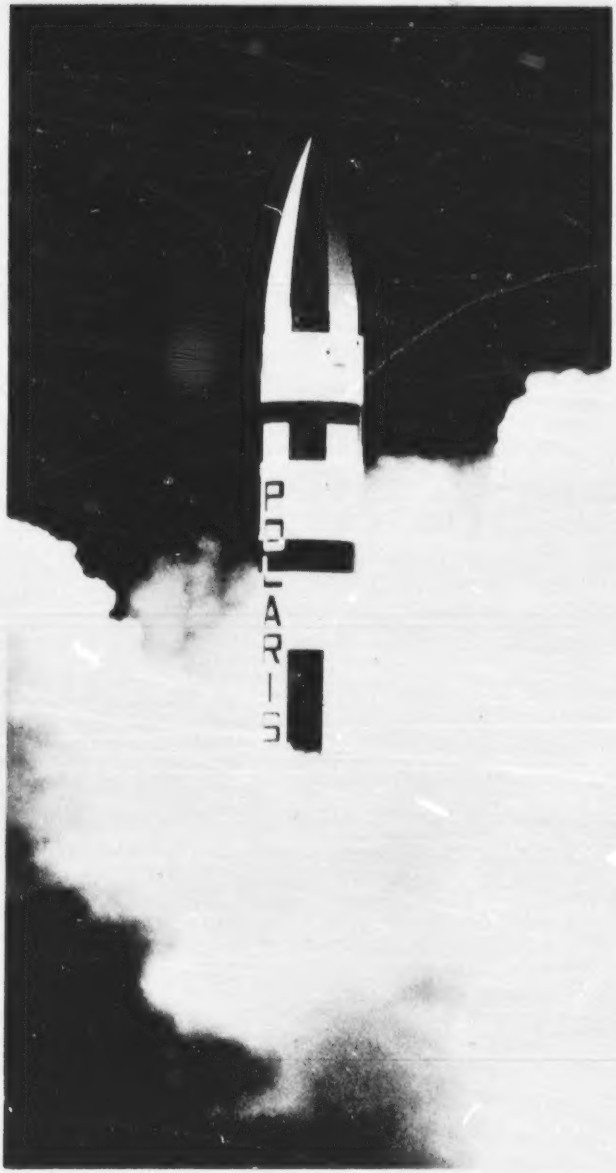

Figure 61. A Polaris missile.

Active AAW refers to any action taken to destroy or reduce the enemy air and missile threat. It includes such measures as the employment of fighters, bombers, antiaircraft guns, surface-to-air and air-to-air missiles, and electronic countermeasures. It seeks to destroy the air or missile threat before it can be launched. Passive AAW is a reference to such actions as concealment, dispersion, deception (including electronics), and mobility.

The primary weapons employed in active antiair warfare are air-to-air missiles, surface-to-air missiles, and antiaircraft guns. The Navy employs three types of surface-to-air missiles: the Talos, the Terrier, and the Tartar (the so-called 3T family). The **Talos** is a long-range surface-to-air missile powered by a combination ramjet engine and a solid-propellant booster (Fig 62). It uses a semiactive radar homing device and has a range of more than 75 miles and a ceiling of 100,000 feet. The **Terrier** has a solid-fuel rocket motor and uses homing guidance. It has a range of approximately 40 miles and a ceiling of about 50,000 feet. Both the Talos and the Terrier can be equipped with nuclear or nonnuclear warheads. The **Tartar** is a short-range missile with a range of approximately 20 miles and a ceiling of about 50,000 feet. It uses homing guidance and can be equipped with a nonnuclear warhead. These missiles were employed in Southeast Asia, downing several North Vietnamese Mig jet fighters.

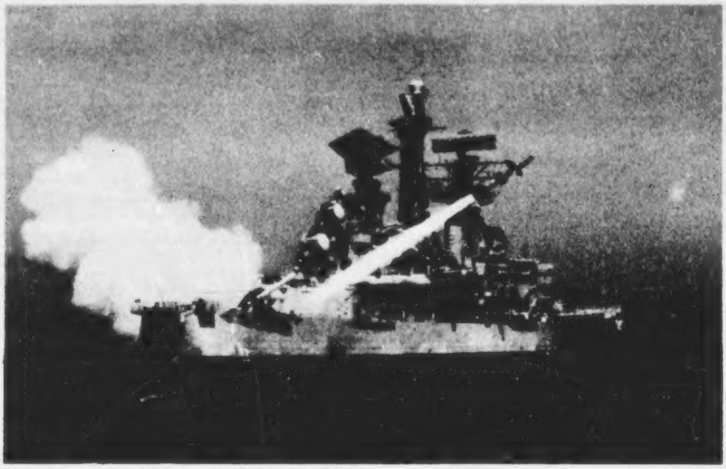

Figure 62. Talos missile launched from the USS Little Rock.

The primary air-to-air missiles employed by the Navy are the Sidewinder and the Sparrow, the same as those used by the Air Force. However, the F–14 Tomcat is equipped with six Phoenix missiles as its primary armament.

The principal antiaircraft guns in use by the Navy are the 3″ and 5″ guns carried on almost all Navy ships. These are dual purpose guns that can be used against either air or surface targets, but their use against modern jet aircraft is severely limited by range and ceiling capabilities.

### Antisubmarine Warfare Operations

Traditionally, submarines have conducted submerged operations in relatively limited areas on the earth's surface. Even so, they have always been effective weapons in naval warfare. During World War II, German U-boats almost succeeded in gaining control of the Atlantic from the United States and Great Britain. Modern nuclear-powered missile submarines are military aerospace weapon systems with many capabilities. In the hands of an potential enemy, these submarines pose a serious threat to the security of the United States, and, as aerospace weapon systems improve, the capabilities of missile submarines likewise improve. To counter this threat, the United States must develop and maintain a capability to conduct effective antisubmarine warfare (ASW) operations. Although the experiences of World War II are useful in developing ASW techniques, there are still many unsolved problems.

One of the major problems confronting ASW forces is that of locating the submarine. The Navy has modified echo ranging sound gear (sonar) used in World War II to produce a continuous underwater scanner. This device presents an image similar to that of the plan position indicator presented by conventional radar screens. All destroyers and other escort craft are equipped with this gear. In the air, radars have been perfected to detect even the snorkel of a cruising submarine, and magnetic detection can track a submerged vessel. Devices to trace the infrared radiations and even the minute thermal differences of disturbed water can also be developed. Currently, however, the problem of long-range tracking of submerged submarines is still not completely solved.

ASW forces have a threefold mission: to destroy enemy submarines before they get to sea; to destroy them enroute to their target; or to destroy them in their target area. This mission involves three operational phases. Submarines concentrated in building yards offer the most vulnerable targets. Depending on the element of surprise, many enemy submarine forces can be destroyed before they reach their assigned operating areas. Submarines equipped with ballistic missiles would be an important element of an attack on enemy building yards.

To perform the second phase of the ASW mission—destruction of enemy submarines enroute to their target—the Navy depends on its ASW force known as the hunter-killer **(HUK) group.** The HUK group is a trained submarine-killer team that conducts combined ASW operations with specially equipped submarines, S-2E Tracker, SH-3A Sea King helicopters, and other aircraft. In addition, a squadron of eight destroyers provides sonar detection and lethal antisubmarine weapons. By using a combination of aircraft carriers, destroyers, fixed-wing aircraft, and helicopters, HUK groups operating in areas of enemy concentration can conduct a constant search for enemy submarines.

Although ASW forces are capable of destroying large numbers of submarines enroute to their target, some submarines will reach their target areas. Upon reaching their assigned stations, they will be in a position to sink US ships or lob missiles into the heart of American cities. At this point, in defense of US shipping convoys and cities, HUK groups, escorting destroyers, land-based aircraft, and American submarines must seek out and destroy the enemy submarines before they can launch their torpedoes and missiles.

The following example shows how a HUK group composed of men, weapons, aircraft, and ships combine their forces in a hypothetical situation encountered in the North Atlantic:

A radar operator on a P-3A Orion flying in its assigned sector detects an unidentified surface object on his radar. The aircraft commander immediately alters his course to close the range and prepares for an attack. At the same time, he informs the task group commander of the situation and his action. The P-3A rapidly closes to visual range, determines that the object is an enemy submarine snorkel, and begins an attack. The submarine dives. The aircraft returns to the attack point and conducts a magnetic airborne detector (MAD) investigation to regain contact with the submarine. At this point, the crew may use a pattern of buoys equipped with sonar to track the submerged submarine. Shortly thereafter, a helicopter arrives at the target area and lowers its sound dome. It is then coached on the target by the tracking patrol aircraft. When the destroyers arrive, they are directed to the target by the helicopter, and they begin a series of simulated attacks on the submarine. In the event of a war, the outcome will depend on how quickly and effectively the HUK groups can complete the detection, identification, and destruction of an enemy submarine fleet.

Obviously, before an enemy submarine can be attacked, its position must be determined. One of the most effective antisubmarine weapons is the acoustic homing torpedo that moves in a trajectory on its way to the target. It can be launched from any type of aircraft or ship, and it carries an electronic device that selects true targets from enemy decoy targets. The ASW weapon with the longest lethal range is **Lulu,** an airborne nuclear depth charge. Lulu has a destructive potential up to several miles from the point of detonation, and it can virtually eliminate enemy submarine concentrations such as those employed by the Germans in World War II. Weapon **Alfa** is a rocket-fired depth charge with a much greater range than conventional depth charges. Alfa can carry a heavier explosive charge without endangering the launching ship. ASROC is a long-range ASW weapon for installation on surface ships. It uses a large rocket motor to deliver its payload to the submarine under attack. Still another ASW weapon is SUBROC, which can be launched from submerged submarines. This weapon has a much greater range than currently available submarine torpedoes, and it can be fitted with either nuclear or conventional warheads. It can detect a submarine at long range, compute the submarine's course and speed, and fire the missile, all in one operation.

## UNITED STATES MARINE CORPS

The US Marine Corps functions as a separate Service within the Department of the Navy. Its mission is to provide Fleet Marine Forces, including air components, for seizing and defending advanced naval bases and conducting operations essential to naval campaigns. The Corps also develops, with the Air Force, Army, and Navy, the tactics, techniques, and equipment used by landing forces in amphibious operations. Marine aviation provides air support to Fleet Marine Forces in the execution of amphibious operations. Each Fleet Marine Force consists of one or more Marine divisions, one or more air wings, and force troops (combat support and service units to reinforce divisions and air wings). Marine divisions and aircraft wings are always located together for employment as Marine air-ground teams.

The Marine division is the basic Marine Corps ground organization. In general, aviation commands in the Fleet Marine Force have the same organizational structure as the Marine division. However, the Marine aircraft wing is a task organization unit tailored for specific purposes. Therefore, no two Marine aircraft wings will contain the same number of units. The basic aviation unit within a wing is the squadron. Depending on the types of aircraft assigned to it, a Marine aviation squadron will have from 12 to 24 aircraft. Marine aviation units are trained to operate either from aircraft carriers or from land bases. They are not functionally organized according to types of aircraft. Instead, each Marine aircraft wing includes a variety of fighter, attack, reconnaissance, transport, and rotary-wing aircraft and light antiaircraft missile units.

One of the most revolutionary aircraft to enter the Marine aerospace force in recent years is the Hawker-Siddeley AV–8A **Harrier,** a V/STOL aircraft with the unique capability of operating like a helicopter or as a fixed-wing aircraft. The AV–8A can take off vertically, hover like a helicopter, and then convert to forward flight at speeds up to 600 miles per hour. In addition, the Harrier has a unique control system. In conventional jet aircraft, the jet exhaust is directed through a tailpipe. The thrust from the Harrier's Pegasus 11 engine is directed through four rotating nozzles, two on each side of the fuselage. A single lever in the cockpit controls the nozzles, which can be directed aft for conventional wing-borne flight or rotated to a vertical position for hovering or jet-borne flight. The pilot can select any intermediate nozzle position to reduce the speed of the aircraft or to provide rapid forward acceleration. One significant advantage of the Harrier is that it can operate from a small deck without a catapult or arresting gear. It can carry almost all external weapons carried by other aircraft, including the MK-series bombs, rockets, cluster bombs, and Sidewinder missiles. In addition, it is equipped with the 30mm Aden gun for use in both air-to-ground and air-to-air roles. The AV–8A can be used in close air support, air combat, and antisubmarine warfare and escort operations.

## WORDS, PHRASES, AND NAMES TO REMEMBER

aerial artillery
Alfa
airmobile division
chaparral
Improved Nike-Hercules
Harrier
Hawk
HUK group
Lulu
MIRV
Nike-Hercules
Safeguard
Talos
Tartar
Terrier
TRICAP division
Vulcan

## REVIEW QUESTIONS

1. **Describe the mission of Army aviation.**
2. **What are the main differences between an airmobile and an airborne division?**
3. **Discuss the relative merits of helicopters and fixed-wing aircraft in tactical uses.**
4. **Explain the role of the aircraft carrier in naval air operations.**
5. **What strategic offensive forces are provided by the Navy?**
6. **Explain the Marine Corps role in aerospace forces.**

## THINGS TO DO

1. As a research project, trace the history of the Navy's Fleet Ballistic Missile forces, giving particular attention to the work of Admiral Rickover in developing nuclear-powered submarines and the work of Admiral Raborn in developing the Polaris missile.
2. Watch for news of new developments in high-speed helicopters or V/STOL aircraft. *Aviation Week* and *Air Force and Space Digest* are good sources for this information.

## SUGGESTIONS FOR FURTHER READING

### Books

ABEL, ELIE. *The Missile Crisis.* New York: J. B. Lippincott Co., 1966.

BORKLUND, C. W. *The Department of Defense.* New York: Frederick A. Praeger, 1968.

BROUGHTON, JACK. *Thud Ridge.* Philadelphia: Lippincott Co., 1969.

CARASTRO, L. R. (ed.). *Of Those Who Fly.* Air Force ROTC: Air University, Maxwell Air Force Base, Alabama, 1972.

CARRISON, CAPTAIN DANIEL J. *The United States Navy.* New York: Frederick A. Praeger 1968.

COOMBS, CHARLES. *Aerospace Power.* New York: William Morrow and Co., 1966.

DONOVAN, COLONEL JAMES A. *The United States Marine Corps.* New York: Frederick A. Praeger, 1967.

GABLEHOUSE, CHARLES. *Helicopters and Autogiros.* New York: J. B. Lippincott Co., 1967.

GOODIE, MAJOR CLIFFORD B. *Strategic Air Command.* New York: Simon and Schuster, 1965.

HIGHAM, ROBIN. *Airpower: A Concise History.* New York: St. Martin's Press, 1972.

KENNEDY, ROBERT F. *Thirteen Days.* New York: W. W. Norton, 1969.

KNIGHT, CLAYTON. *Lifeline in the Sky.* New York: William and Co., 1957.

LeMAY, GENERAL CURTIS E. *America is in Danger.* New York: Funk and Wagnalls, 1968.

*Mission with LeMay.* New York: Doubleday and Co., 1965.

PIZER, LT COLONEL VERNOV. *The United States Army.* New York: Frederick A. Praeger, 1967.

SCRIVNER, LT COLONEL JOHN A., JR. *A Quarter Century of Airpower.* Air Force ROTC: Air University, Maxwell Air Force Base, Alabama, 1973.

TALMADGE, MARIAN and GILMORE, IRIS. *NORAD: The North American Defense Command.* New York: Dodd and Meade, 1967.

TWINING, GENERAL NATHAN F. *Neither Liberty Nor Safety.* New York: Holt, Rinehart, and Winston, 1966.

YARMOLINSKY, ADAM. *The Military Establishment: Its Impact on American Society.* New York, Harper and Row, 1971.

ZOOK, DAVID H. and HIGHAM, ROBIN. *A Short History of Warfare.* New York: Twayne Publishers, 1966.

### Periodicals

*Air Force and Space Digest*
*Aviation Week*
*The Airman*

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